Appendix F

Charts of Plotted Data from Tensiometers with Performance Evaluation and Recommendations

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Charts of Plotted Data from Tensiometers with Performance Evaluation and Recommendations

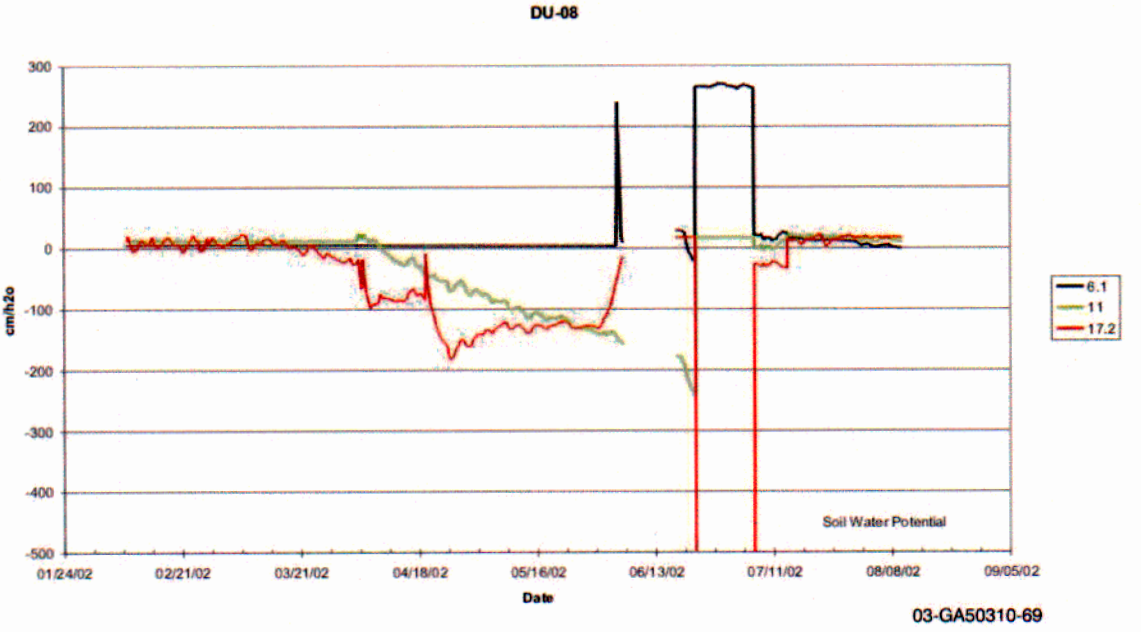
Author: Joel Hubbell

Key to Appendix

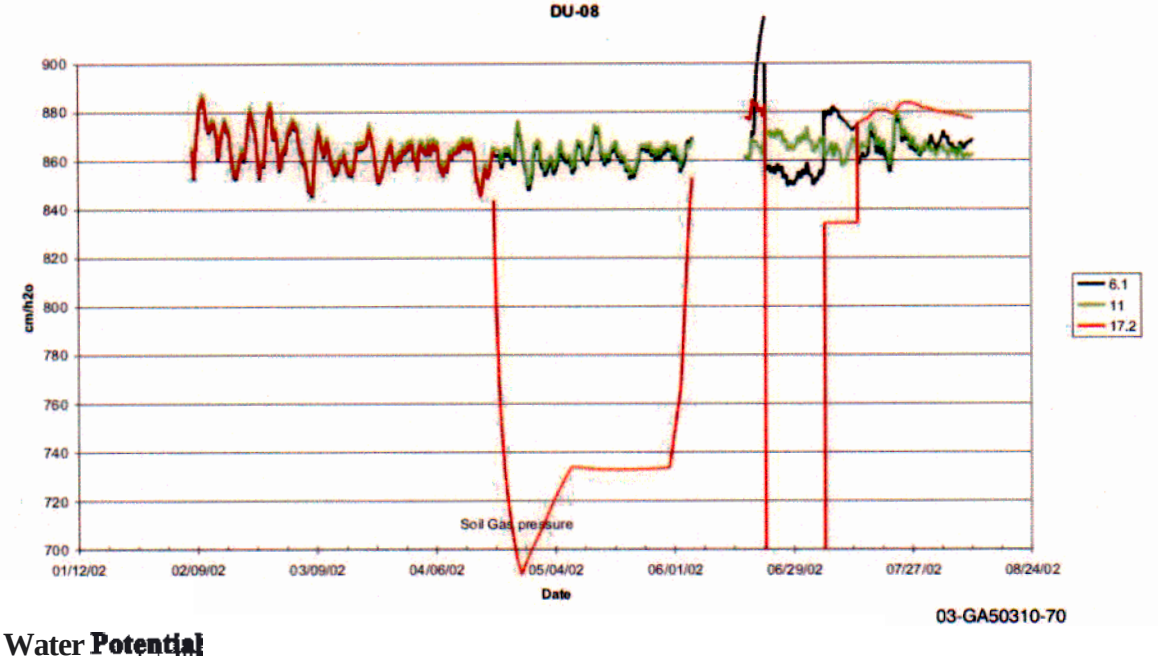
Soil Water Potential: The top graph is the calculated soil water potential data from the tensiometer. It is produced by the measurement from the lower pressure sensor minus the upper pressure sensor's measurement (soil gas pressure). Where the upper pressure sensor is suspected to be nonoperational, the measurement from a different upper pressure sensor in the same well is used for the calculation.

Soil Gas Pressure: The bottom graph is the raw soil gas pressure from the upper sensor. It is presented as recorded with no modification.

Notes: Individual pressure sensors are described by their depth in feet. Many of the tensiometers respond as if the stainless steel membrane has not been fully saturated. Techniques need to be developed to ensure the porous membrane is fully saturated.



03-GA50310-69



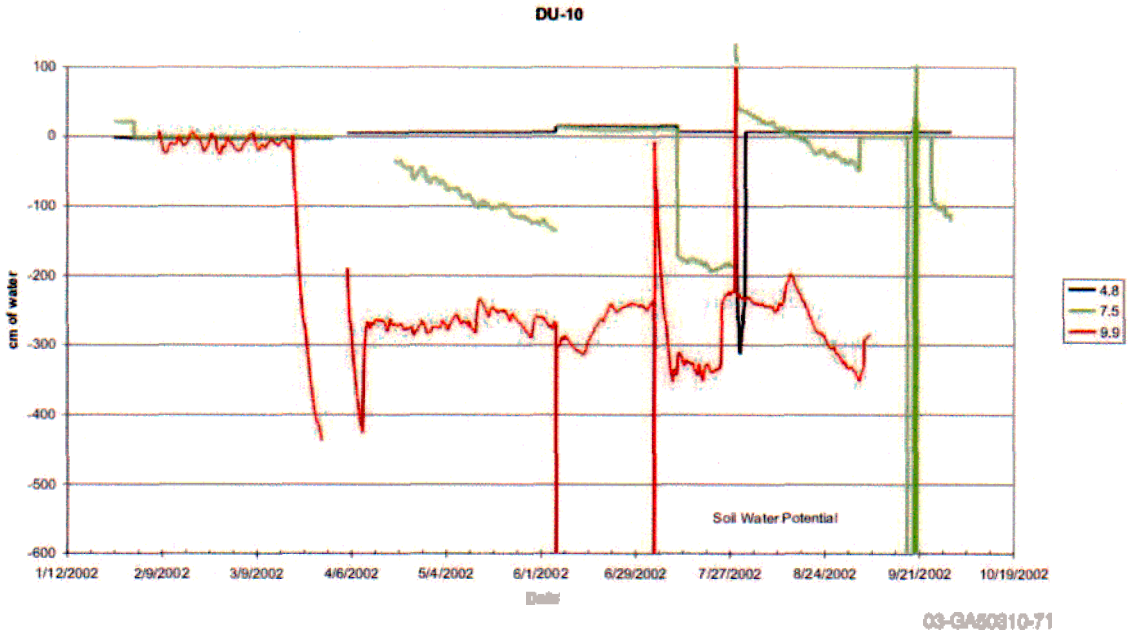
03-GA50310-70

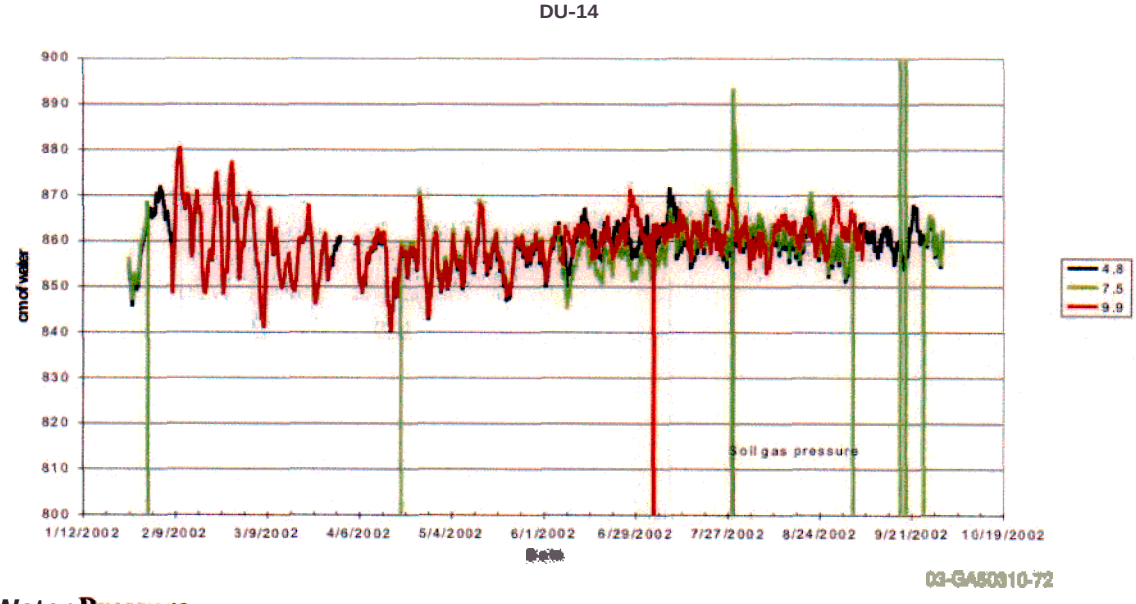
Soil Water Potential

The 6.1 *appears* to need the SS to be wetted. The 11 and 17.2 appear to have responded to wetting and need to be refilled with water.

Soil Gas Pressure

They all tracked closely initially, but in late April the 17.2 deviated for an unknown reason. The 6.1 has several offsets from the barometric pressure (BP) probably caused by performing maintenance.



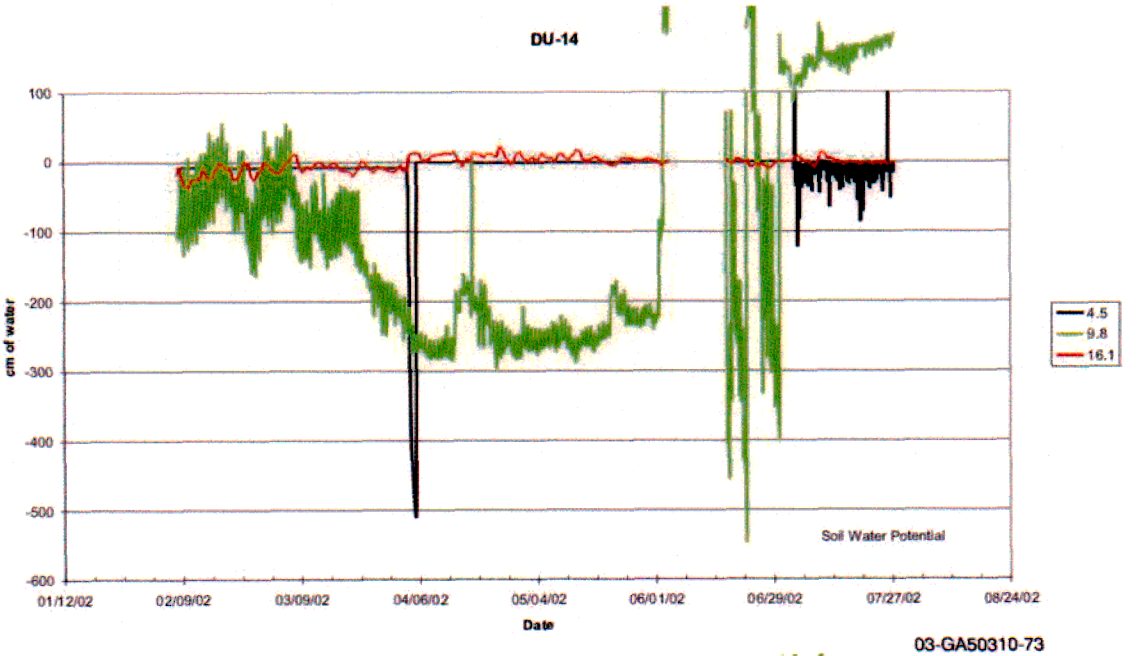


Soil Water Pressure

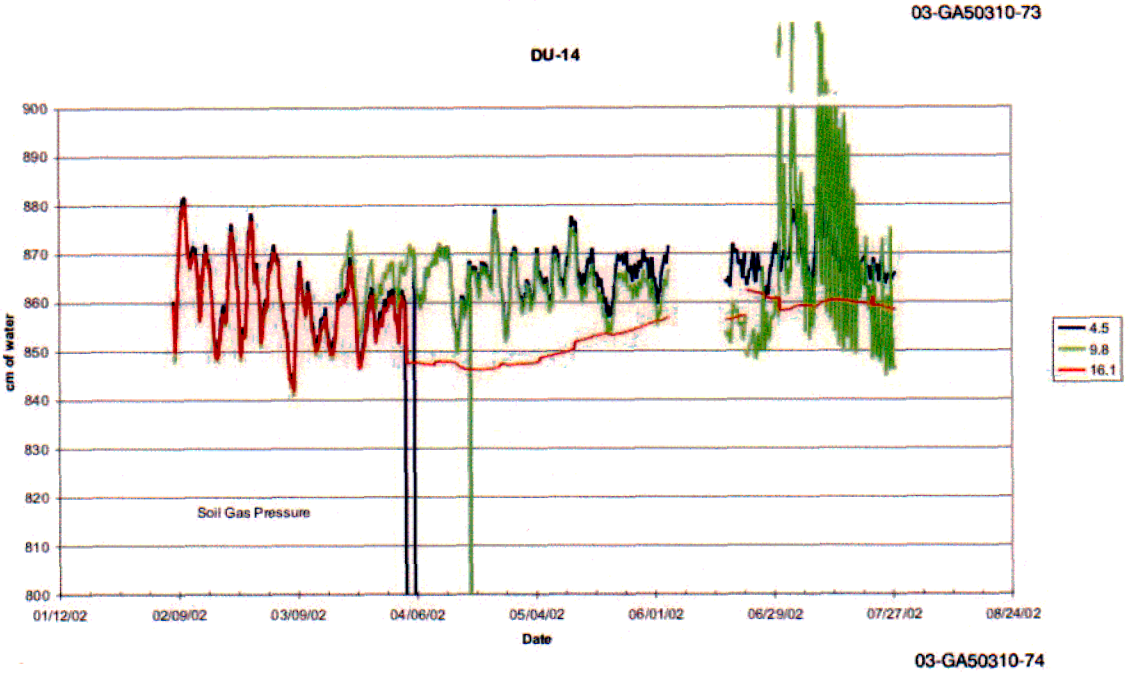
The 4.8 appears to need to be filled with water. The 7.5 was starting to equilibrate but appears to have run out of water and then refilled several times. The *9.9* appears to have been working, but readings have changed significantly over time suggesting to check calibration and the stability of *the* transducer.

Soil Gas Pressure

All three were tracking until about June. Then, the *9.9* shifted out of phase, suggesting electrical problem in that sensor.



03-GA50310-73



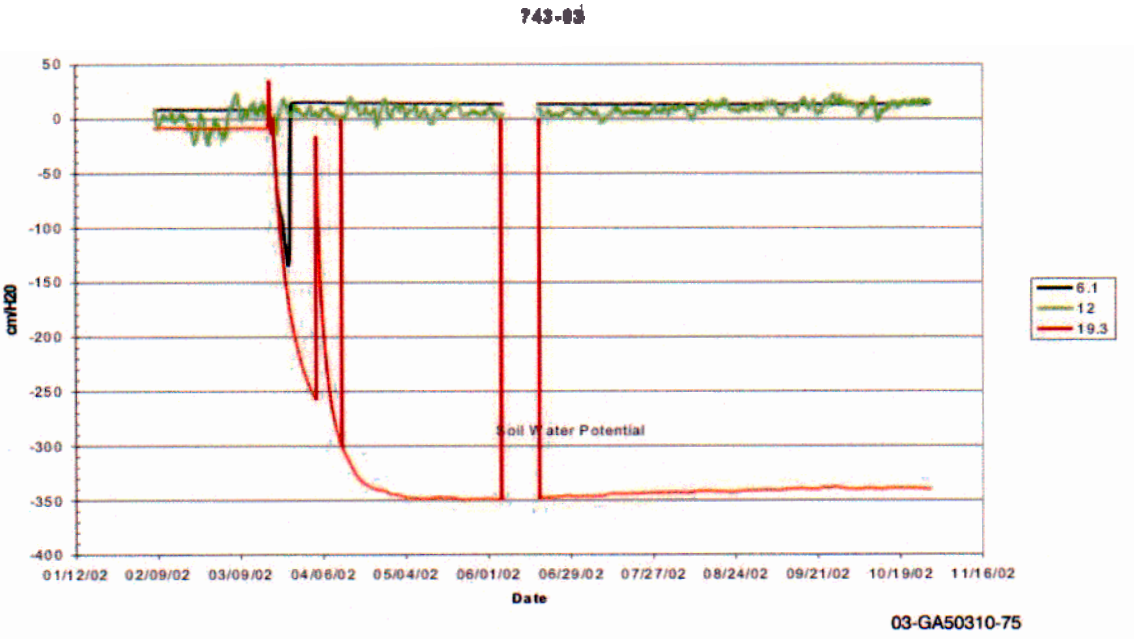
03-GA50310-74

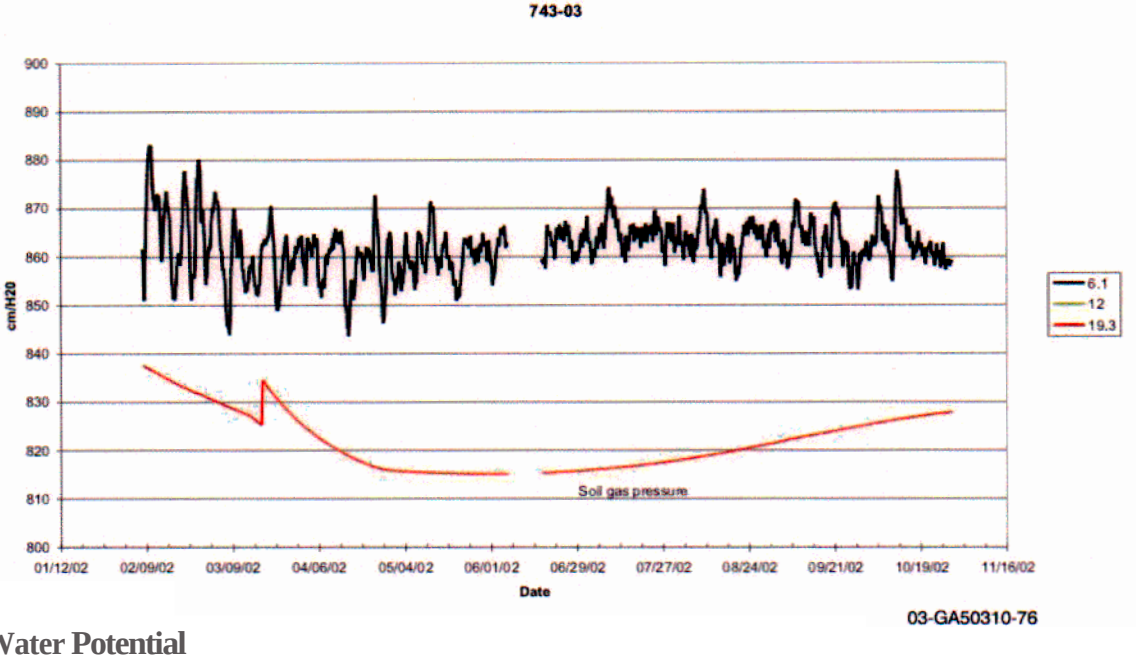
Soil Water Pressure

The 4.5 needs to be filled with water, and the wiring should be checked between the gas pressure and water pressure transducers. There *appears* to be loose electrical connections starting in June. The *9.8* was starting to equilibrate but *ran* out of water and then started to produce erratic data suggestive of a poor electrical connection. The 16.1 may have reversed wiring with upper sensor. It needs a calibration check.

Soil Gas Pressure

All transducers tracked well until April. The 4.5 and *9.8* tracked until July when the *9.9* became erratic, suggesting a wiring problem in that sensor. The 16.1 is no longer measuring soil *gas* pressure. This suggests reversed wiring with the upper *transducer.*



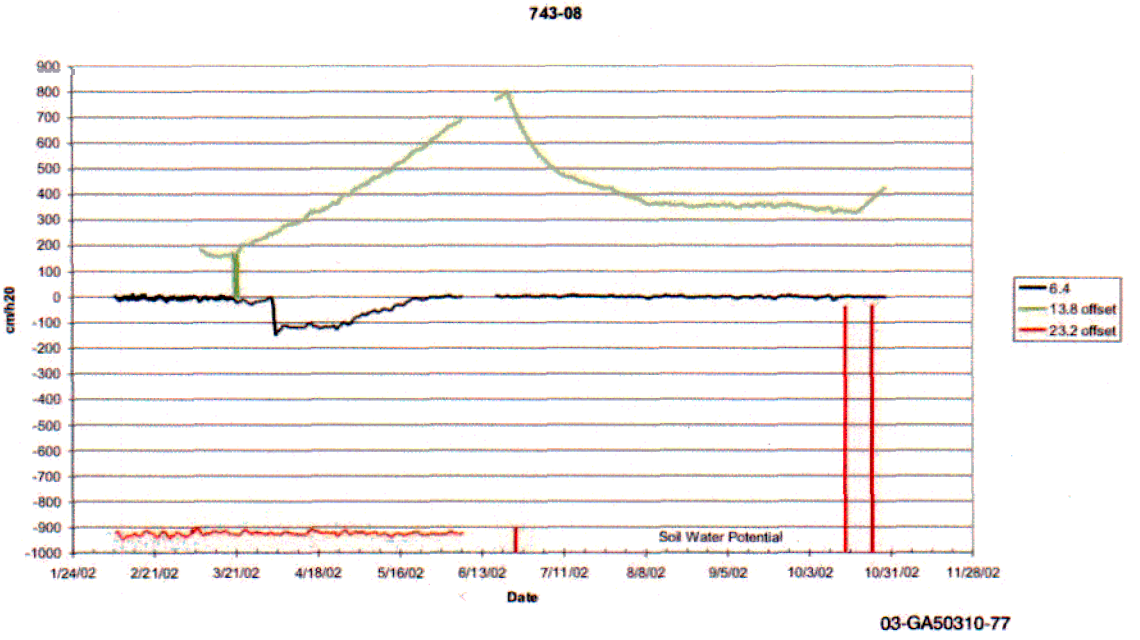


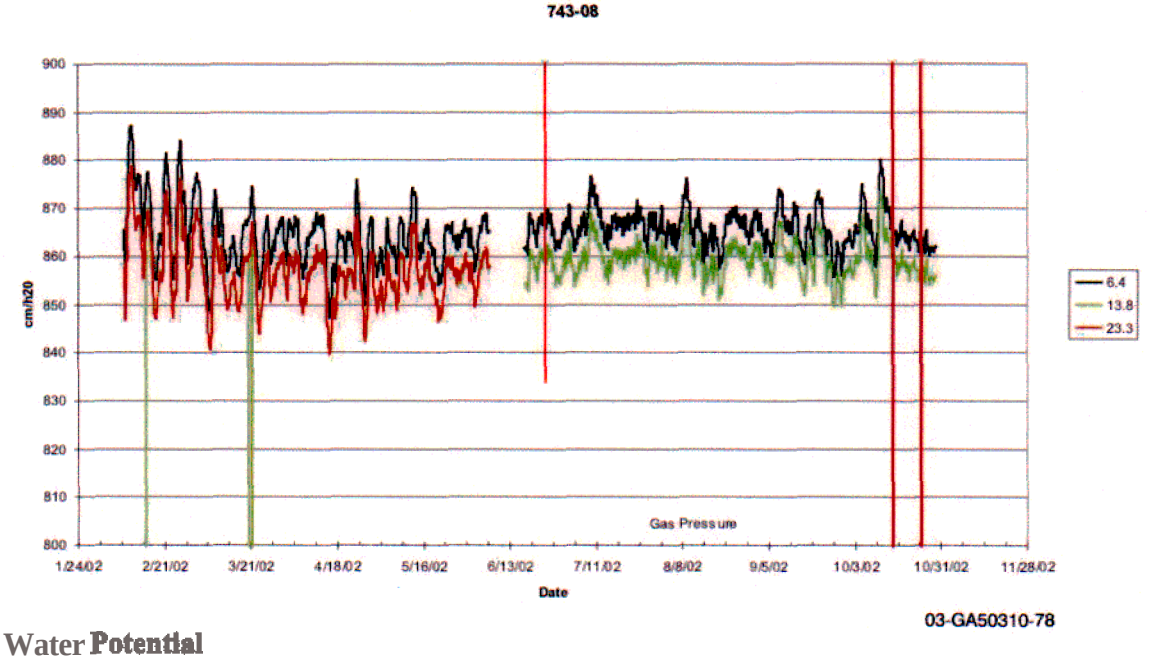
Soil Water Potential

The 6.1 appears to need the SS to be wetted. The 12 responded but needs to be refilled. The 19.2 is running and producing data.

Soil Gas Pressure

The 6.1 appears to be collecting representative data. The 12 transducer does not produce data. The 19.3 suggests there are transducer problems or the sensor is in a low air permeability zone isolated from the atmospheric pressure changes.



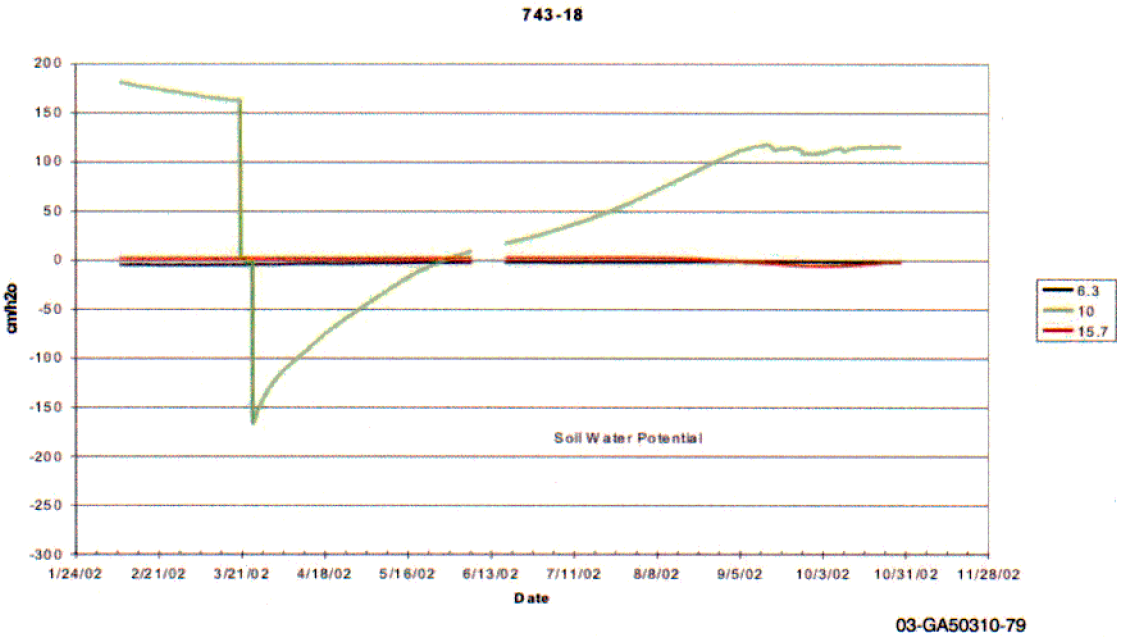


Soil Water Potential

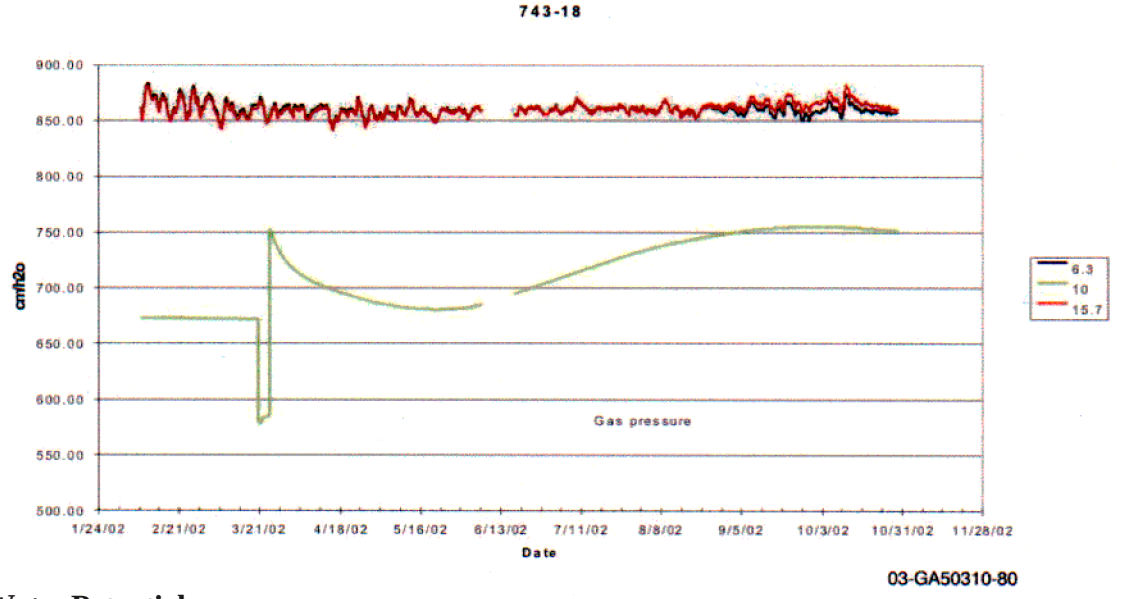
The 6.4 appears to have been running in late March but needs to be refilled to produce data The 13.8 and 23.2 reading are 1,200 and -69, respectively, indicating electrical or sensor problems. Their overall trends over time have been plotted in this graph, not absolute values.

Soil Gas Pressure

The 6.4 appears to be producing representative data. The 23.3 tracked until June when readings shifted, suggesting electrical problems. The 13.8 was connected in June and is providing representative data.



03-GA50310-79



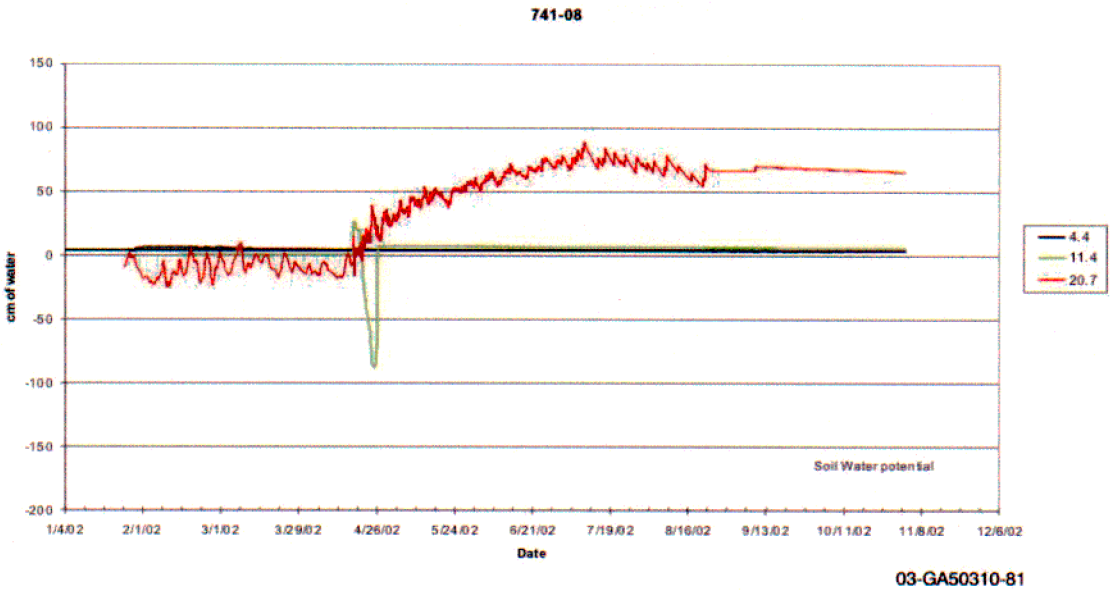
03-GA50310-80

Soil Water Potential

The 6.3 and 15.7 appear to need to be refilled with water. The 10 readings suggest there might be a wiring problem where the sensor outputs are reversed.

Soil Gas Pressure

The 6.3 and 15.7 appear to be producing representative data. The 10 should be checked for correct wiring.



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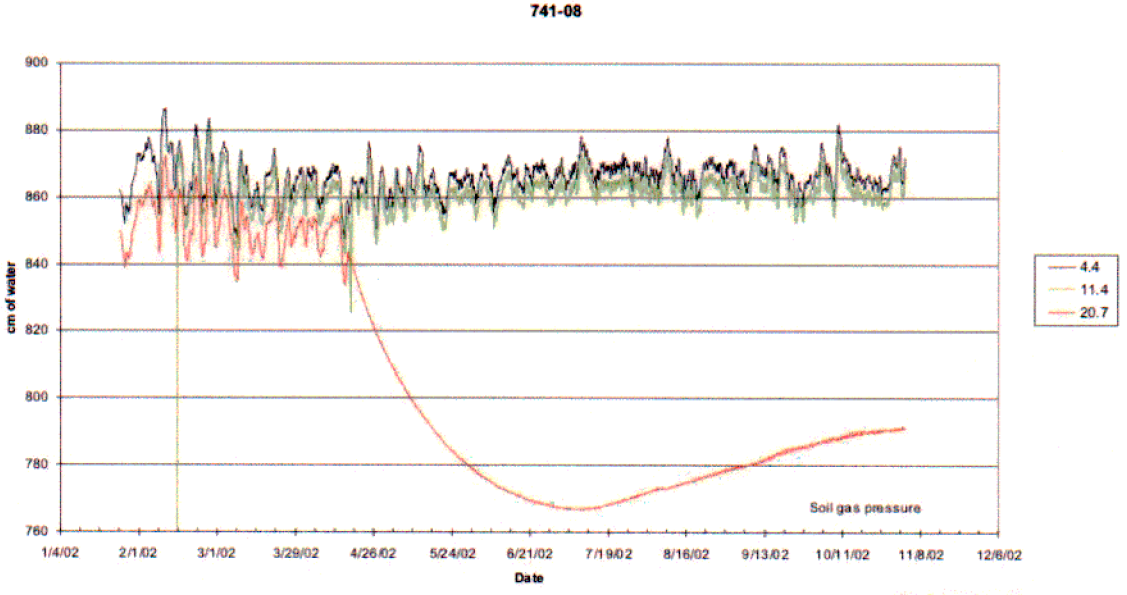


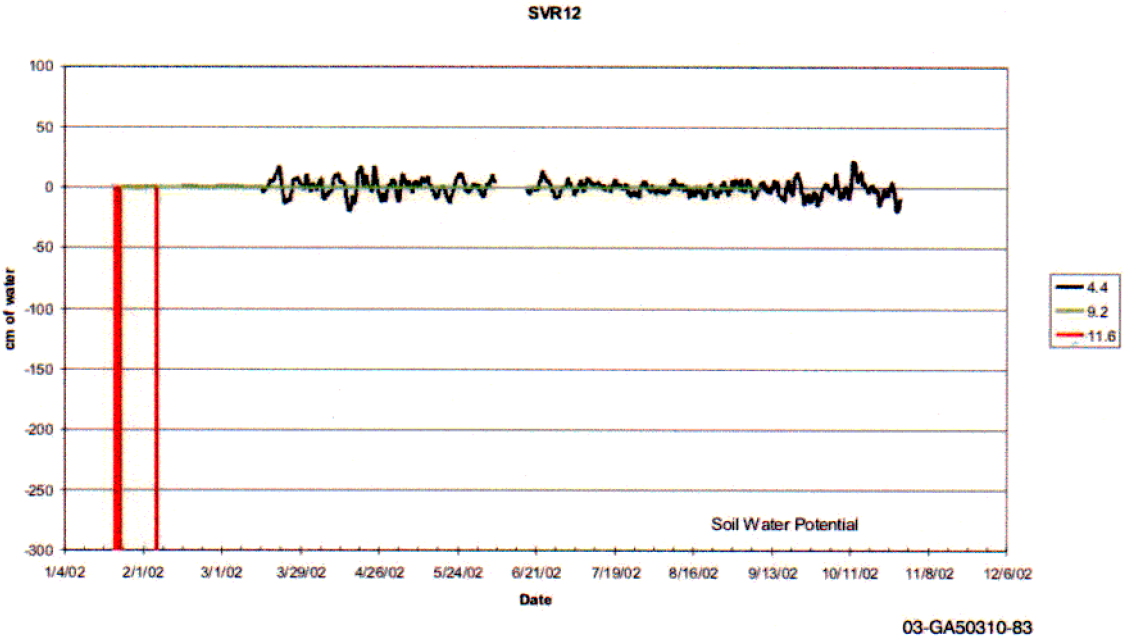
03-GA50310-82

Soil Water Potential

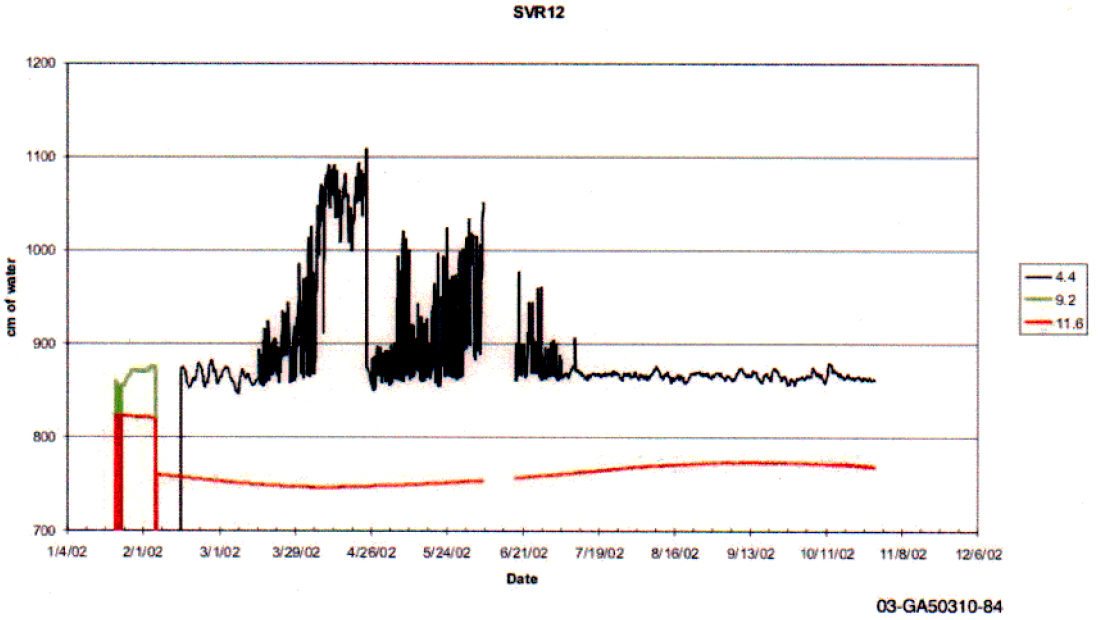
The responses from the 4.4 and 11.4 sensors indicate *they* need to be filled with water. The 11.4 started to respond in April, but the response suggests the SS was not completely wet. The 20.7 readings suggest there is a wiring problem where the upper and lower sensor outputs are reversed.

soil Gas Pressure

The 4.4 and 11.4 sensors appear to be producing representative data. The 20.7 should be checked for correct wiring. The two transducers appear to have been reversed.



03-GA50310-83



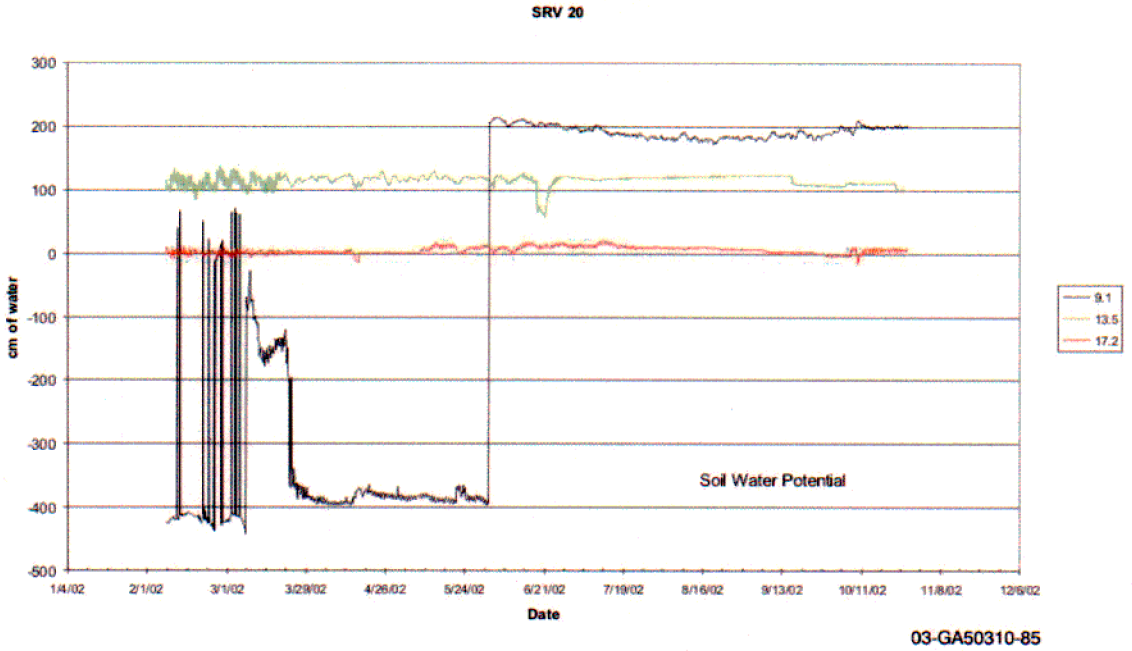
03-GA50310-84

Soil Water Potential

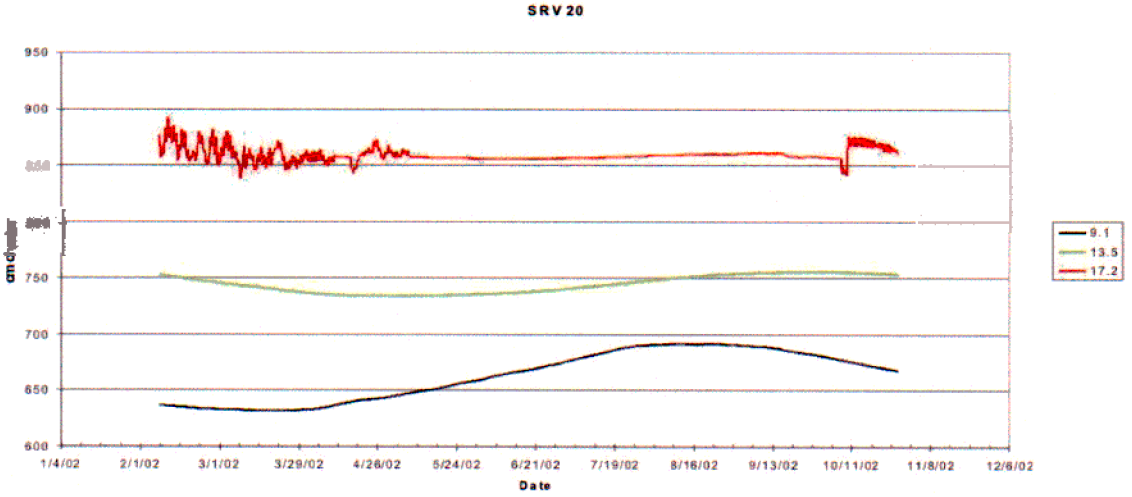
The 6.4 needs to be filled with water. The 9.2 and 11.6 sensors provide a reading of -263 indicative of a sensor or electrical disconnection.

Soil Gas Pressure

The 6.4 and 9.2 sensors appear to have poor electrical connections. The 9.2 worked at first but now reads -263. The 11.6 appears to have reversed wiring with the lower sensor (reading *Field Sampling Plan* [Salomon 2001]).



03-GA50310-85



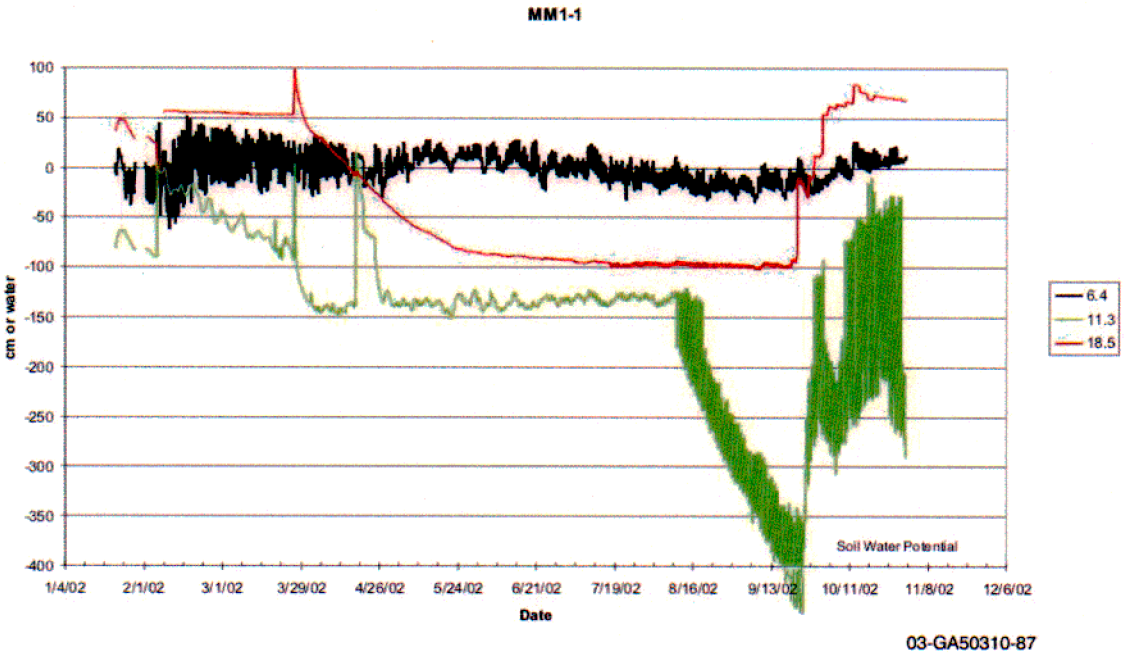
03-GA50310-86

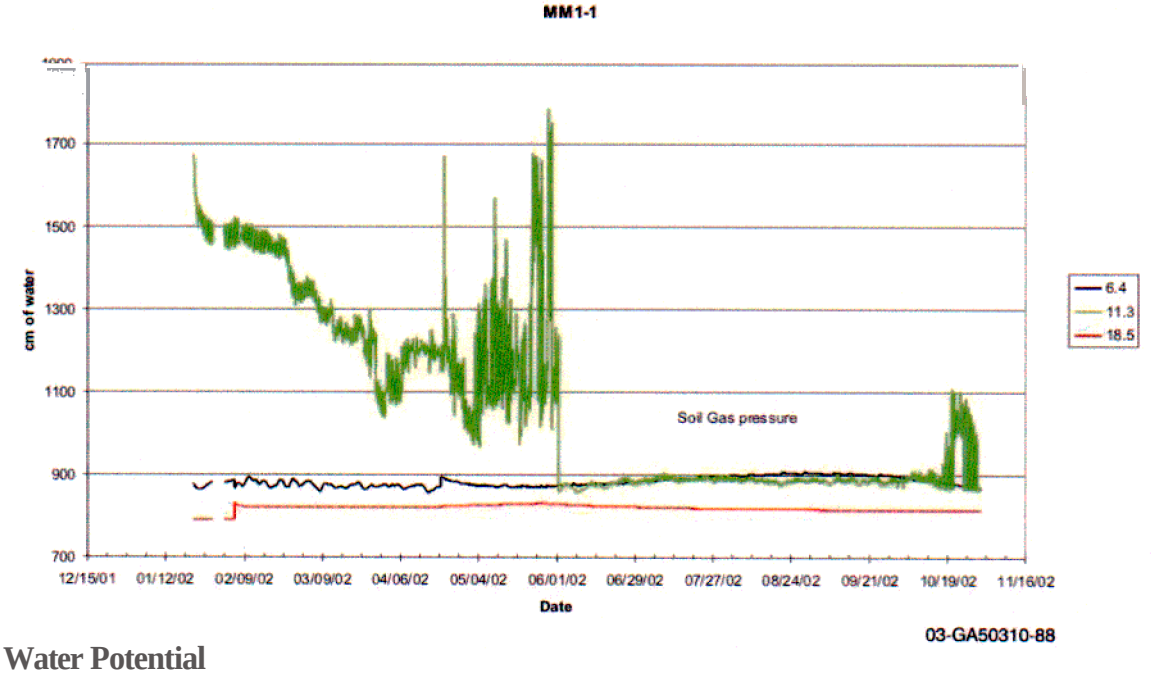
Soil Water **Potential**

All the sensors need connections checked and filled with water.

Soil Gas Pressure

All the **sensors need connections checked for proper response.** There **may be reversed** wiring **in the lower** *two* **instruments.**



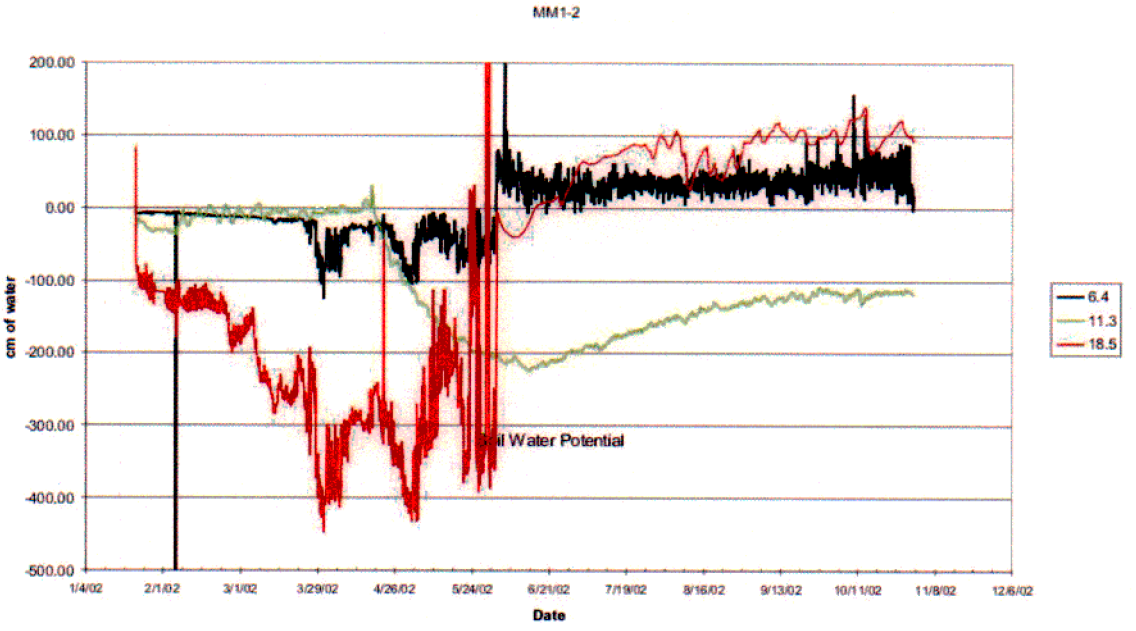


Soil Water Potential

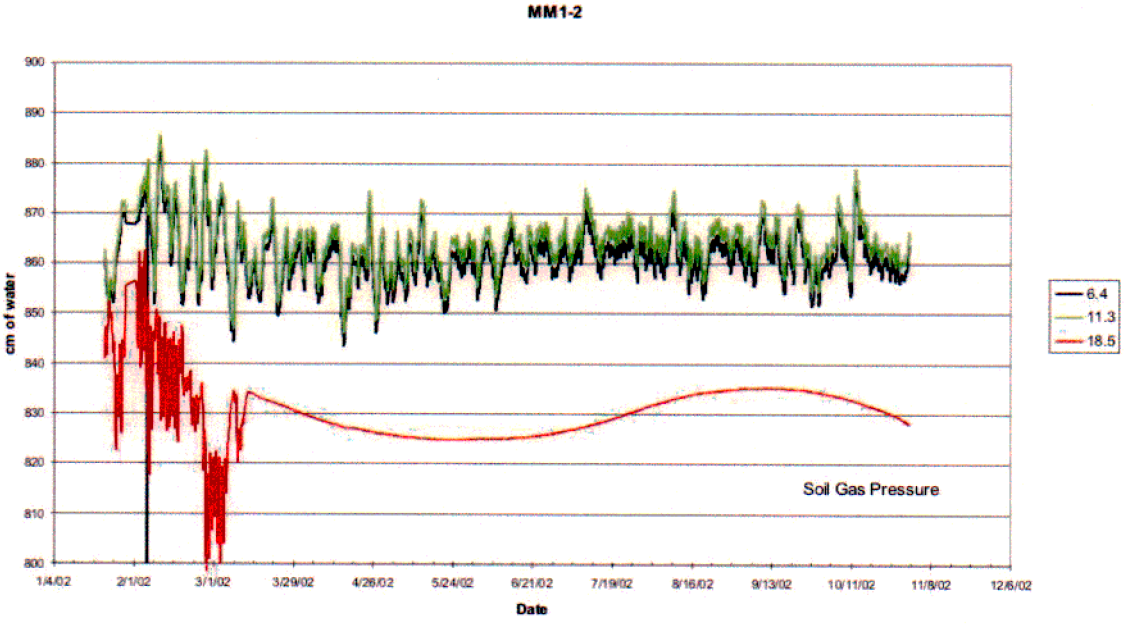
The 6.4 needs to be filled with water. The 11.3 and 18.5 were working. There is a problem with the 11.3 after July, suggesting a poor electrical connection. The 18.5 needs water added.

Soil Gas Pressure

The 6.4 data looked *good* until April and then stopped following the BP. The 11.3 *appears* to have had a poor electrical connection, worked until October, and now has a poor connection. The 18.5 appears to be isolated from the atmosphere.



03-GA50310-89



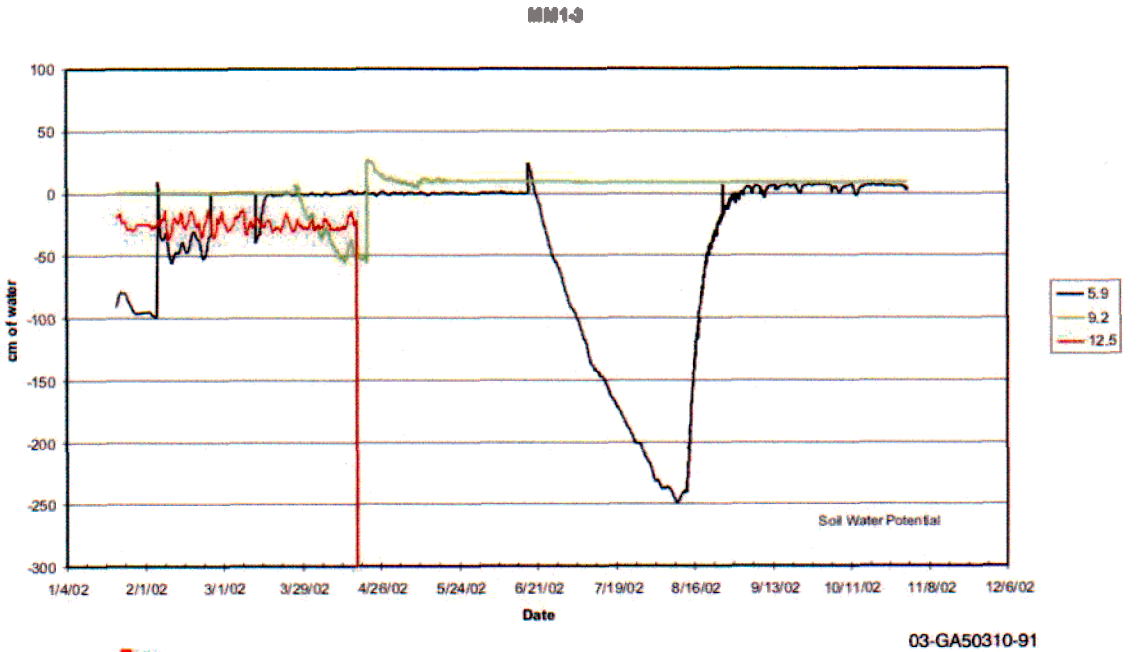
03-GA50310-90

Soil Water Potential

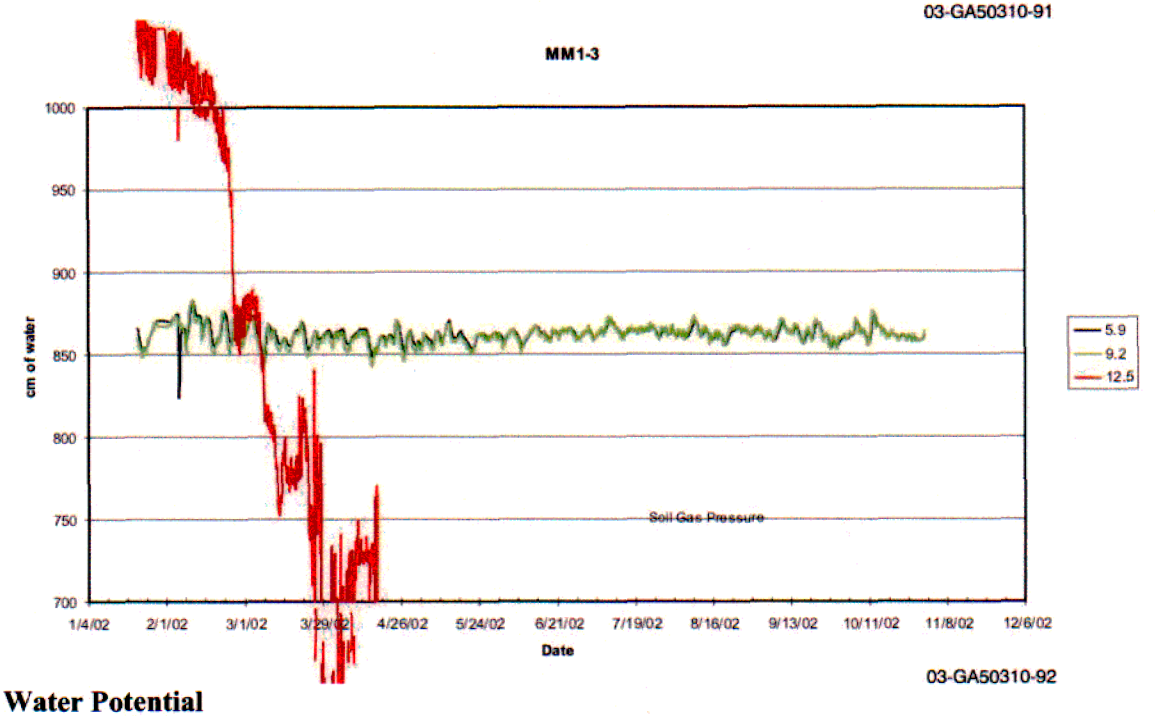
The 6.4 needs to be filled with water and have wiring checked. The 11.3 appears to be working. The 18.5 had wiring problems and needs the calibration checked. It might have the sensors reversed.

Soil Gas Pressure

The 6.4 and 11.3 track each other. The 18.5 appears to be pneumatically isolated from the atmosphere or may have reversed wiring.



03-GA50310-91



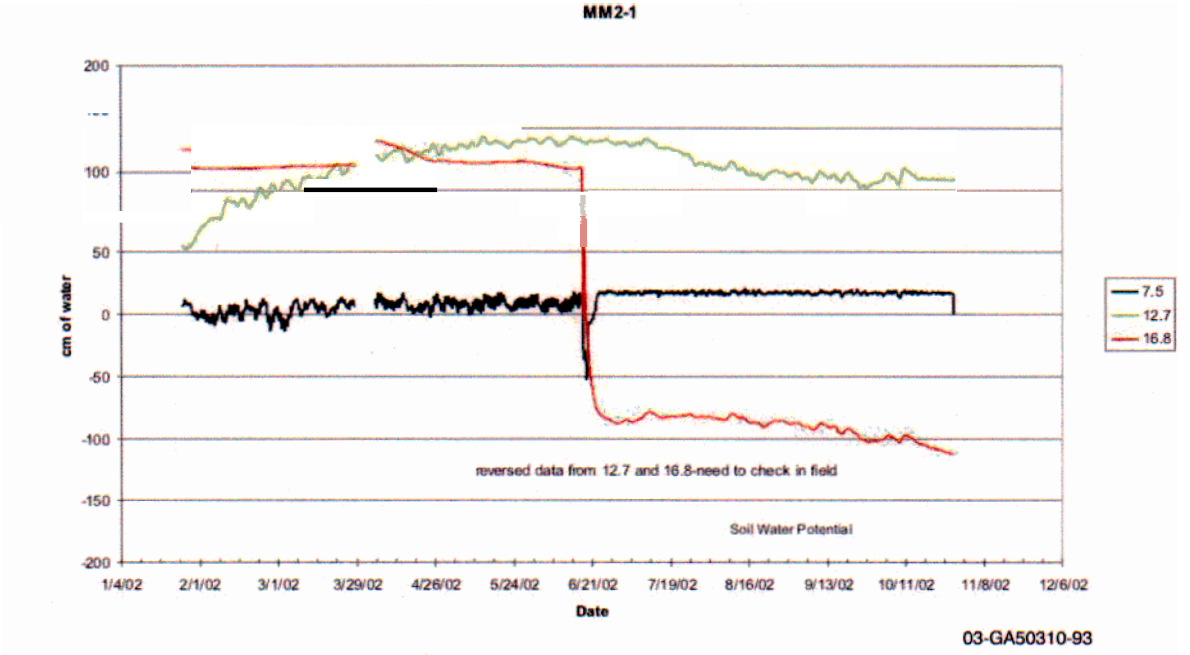
03-GA50310-92

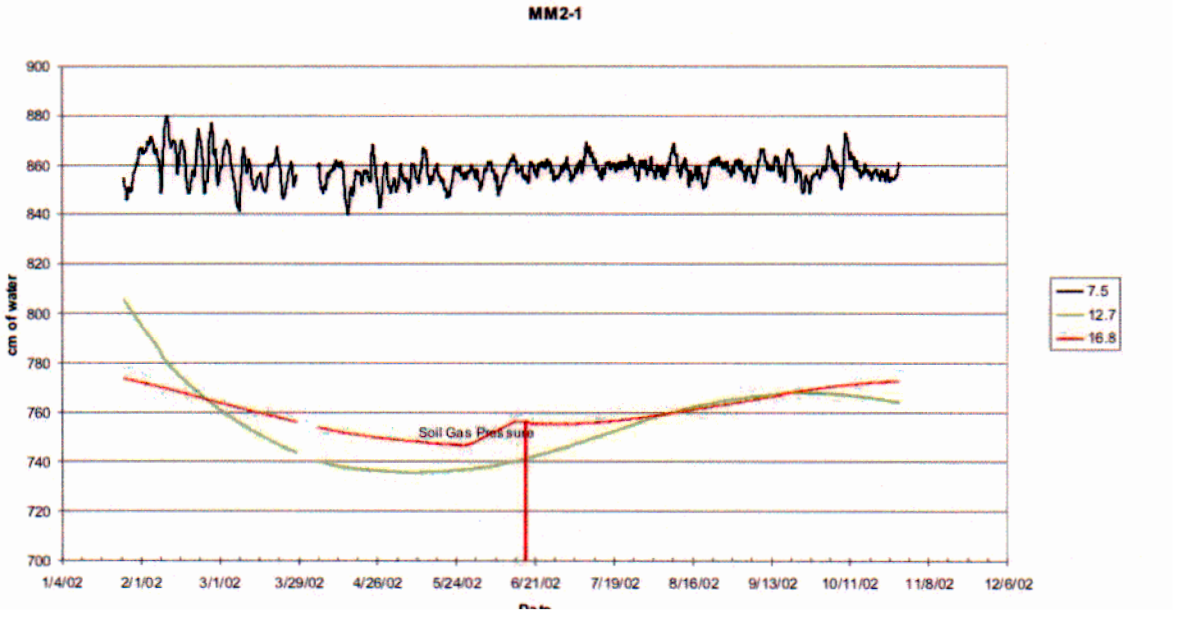
soil Water Potential

The 5.9 needs *to* be filled with water. The *9.2* needs to be filled with water. The 12.5 had electrical problems and is d i n g -263.

Soil Gas Pressure

The *5.9* and *9.2* track correctly. The 12.5 had electrical problems and is reading -263.



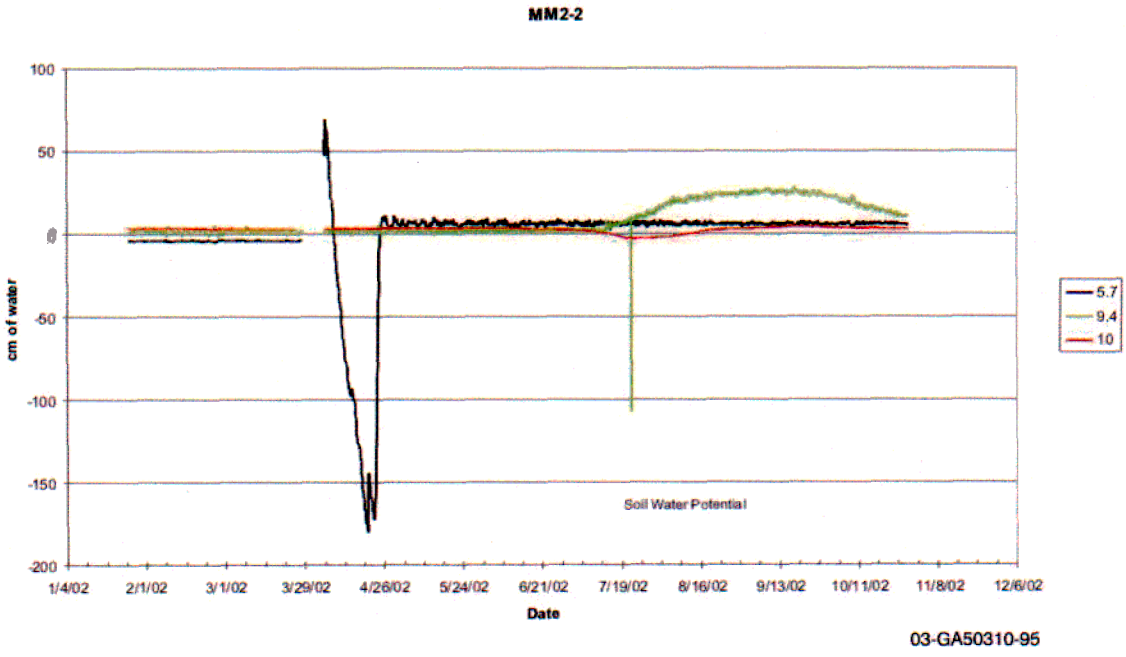


Soil Water Potential

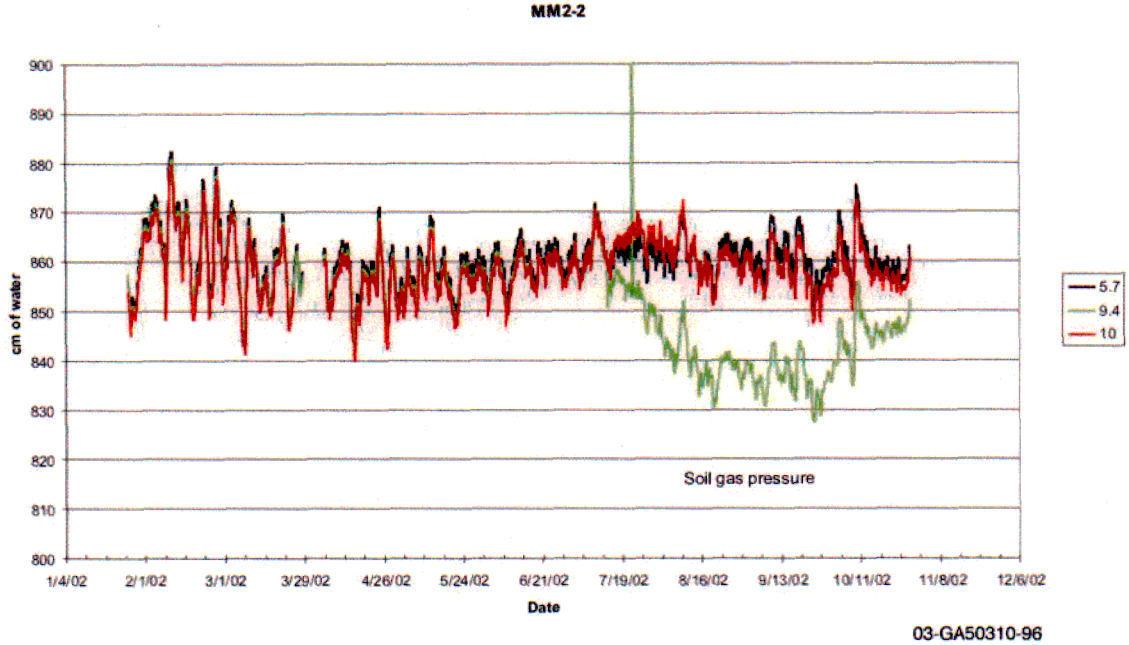
The 7.5 needs to be filled with water. The 12.7 appears to have the wiring switched between the top and bottom sensor. The 16.8 was reversed but was corrected in June.

Soil Gas Pressure

The 7.5 is tracking the BP. The 12.7 appears to have the wiring switched between the top and bottom sensor. The 16.8 was reversed but was corrected in June. It appears to be isolated from the BP.



03-GA50310-95



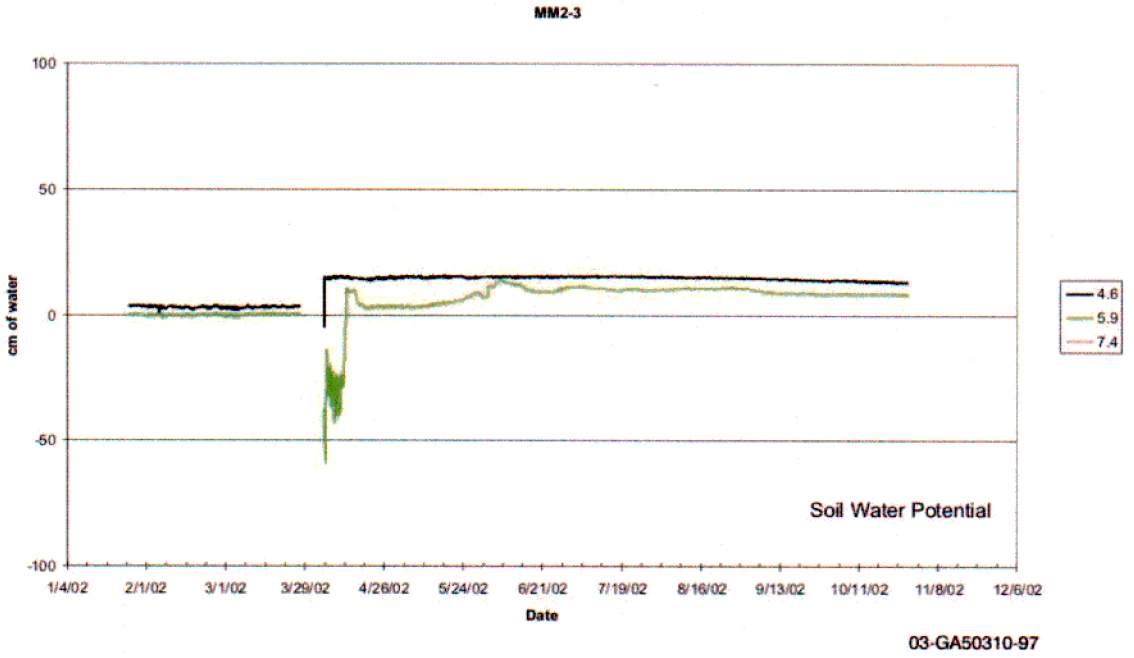
03-GA50310-96

Soil Water Potential

All the sensors need to be filled with water. The 9.4 might have the wiring switched between the top and bottom sensor.

Soil Gas Pressure

All the sensors tracked the BP; however, the decrease in the 9.4 suggests reversed Wiring.



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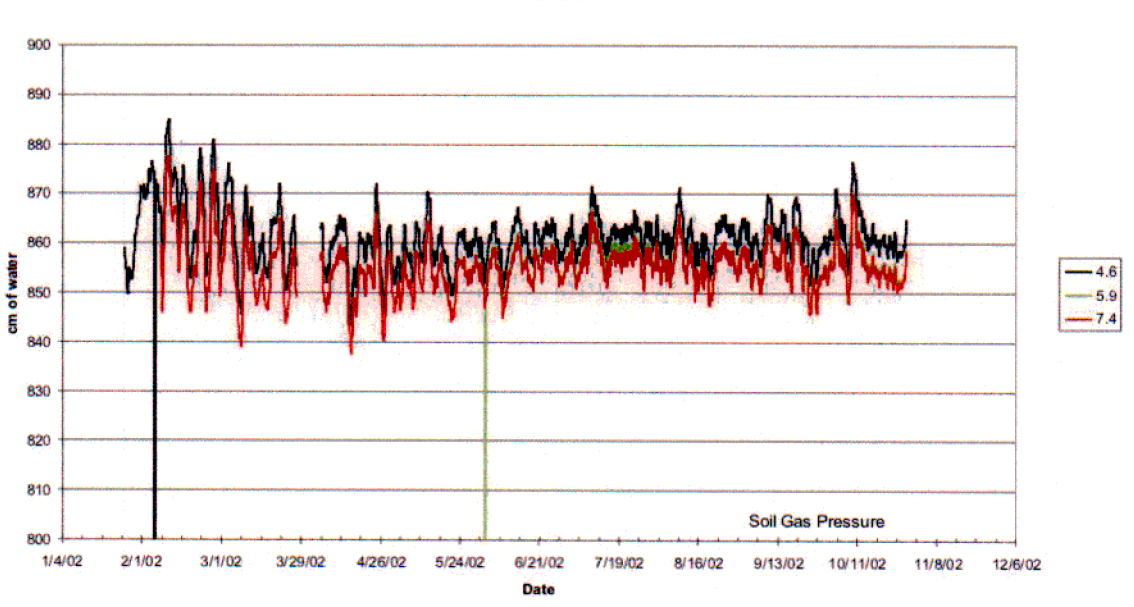


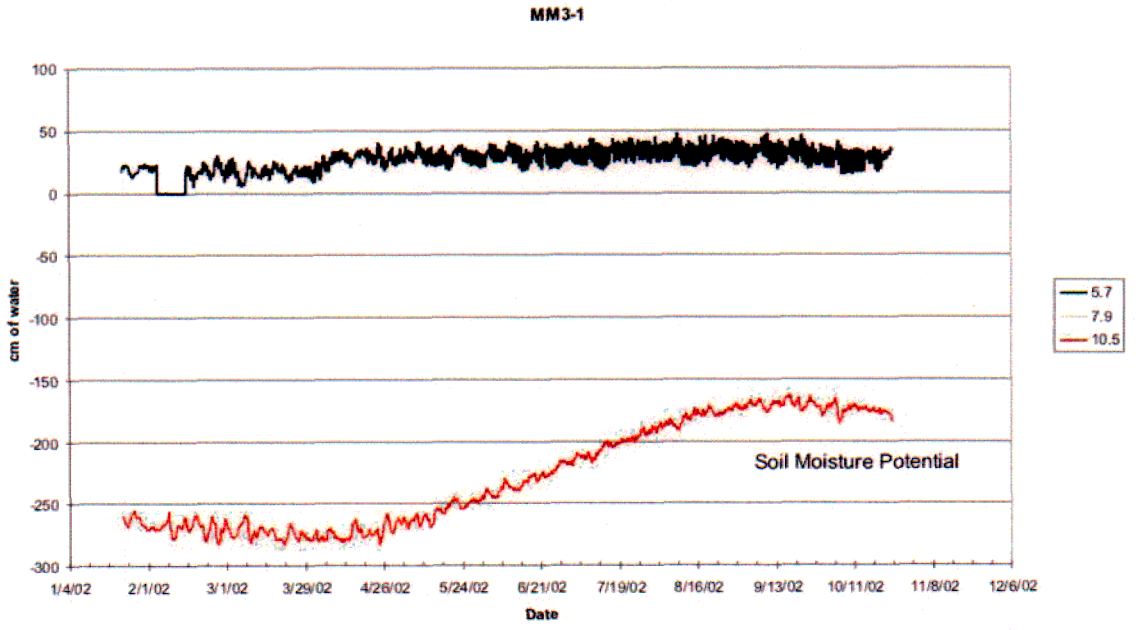
03-GA50310-98

Soil Water Potential

The upper two instruments need to be filled with water. The 7.4 is reading -263, suggesting an electrical problem.

Soil Gas Pressure

All three sensors are tracking the BP.



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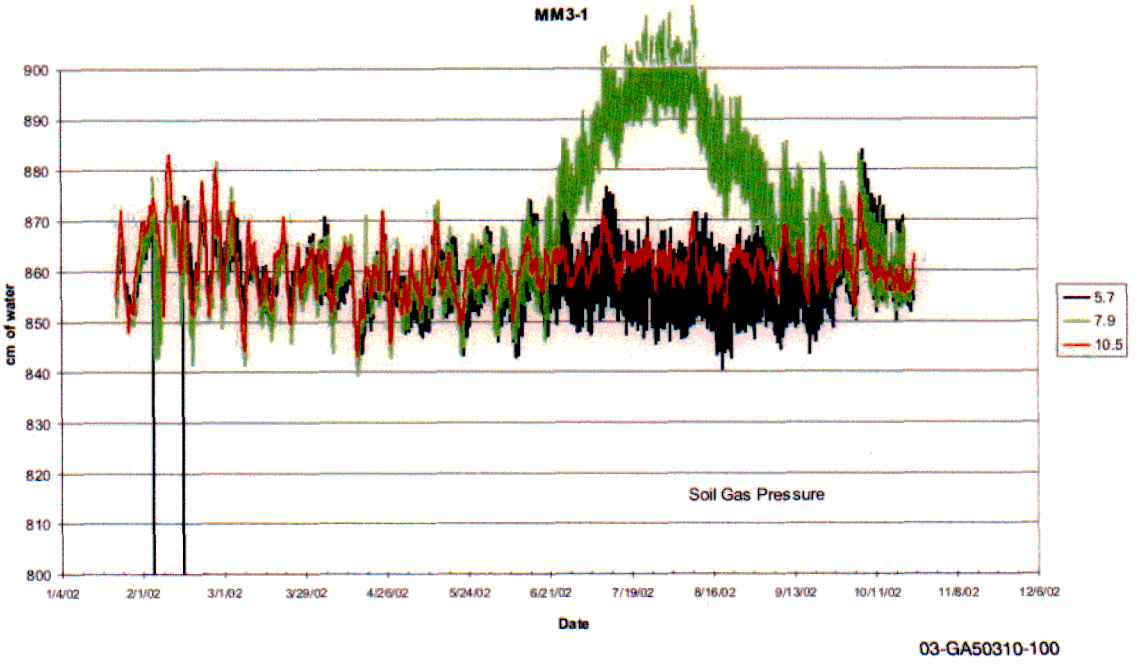


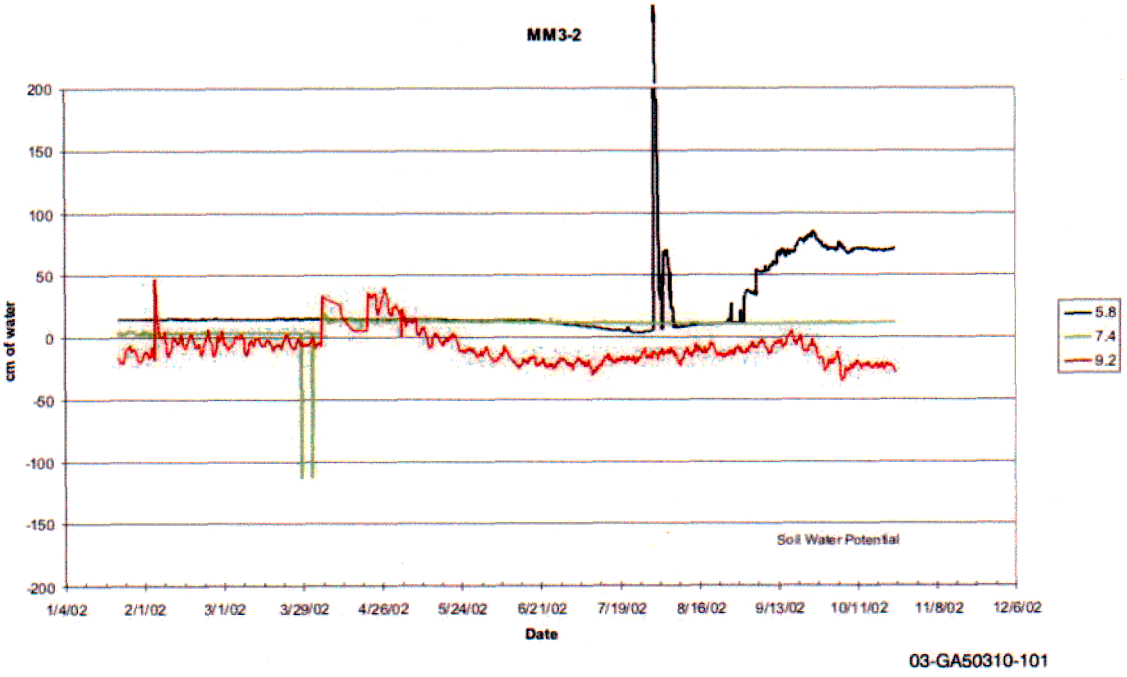
03-GA50310-100

Soil Water Potential

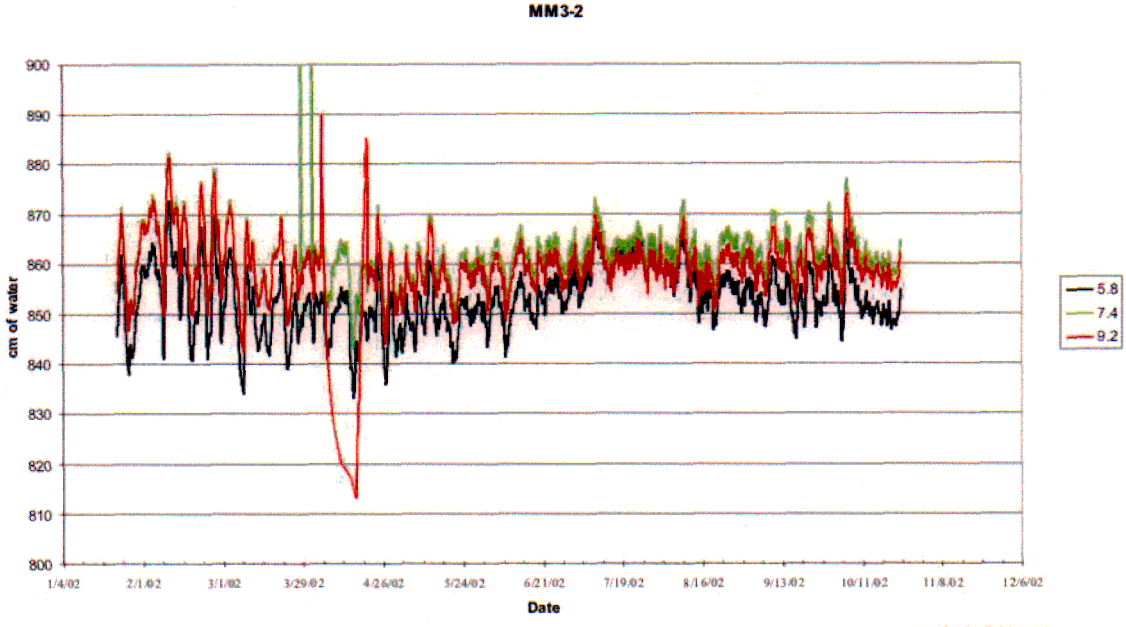
The 5.7 needs to be filled with water. The 7.9 has electrical problems and is reading -263. The 10.5 appears to be operating. It should be refilled with water.

Soil Gas Pressure

The 5.7 and 7.9 have high electrical noise. The 10.5 appears to be operating.



03-GA50310-101



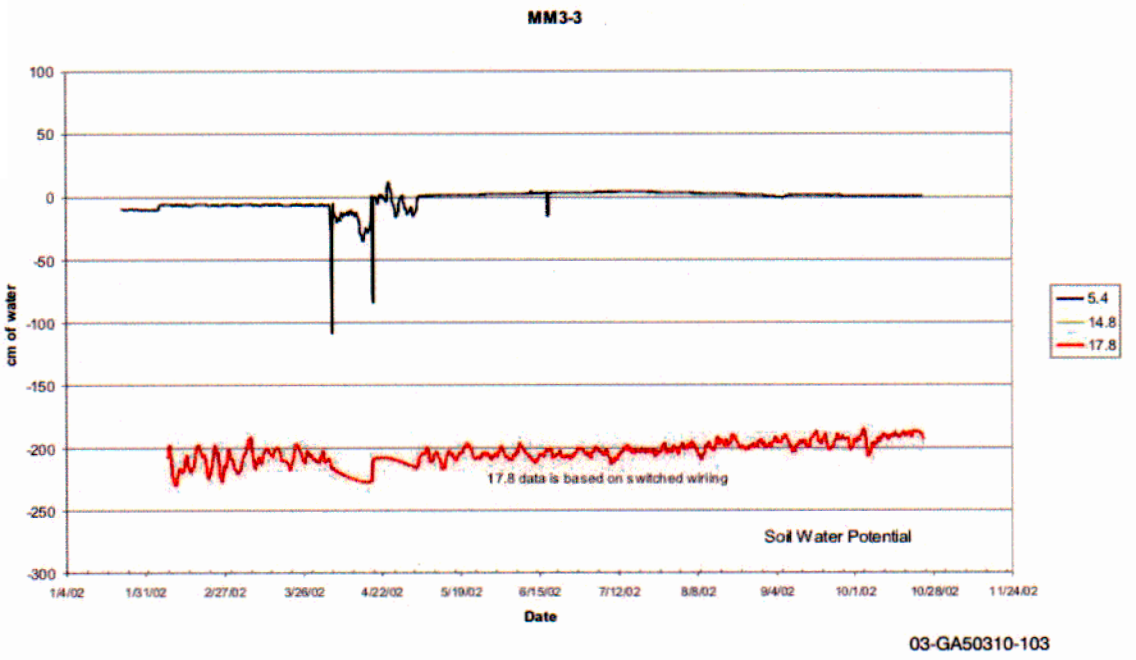
03-GA50310-102

Soil Water Potential

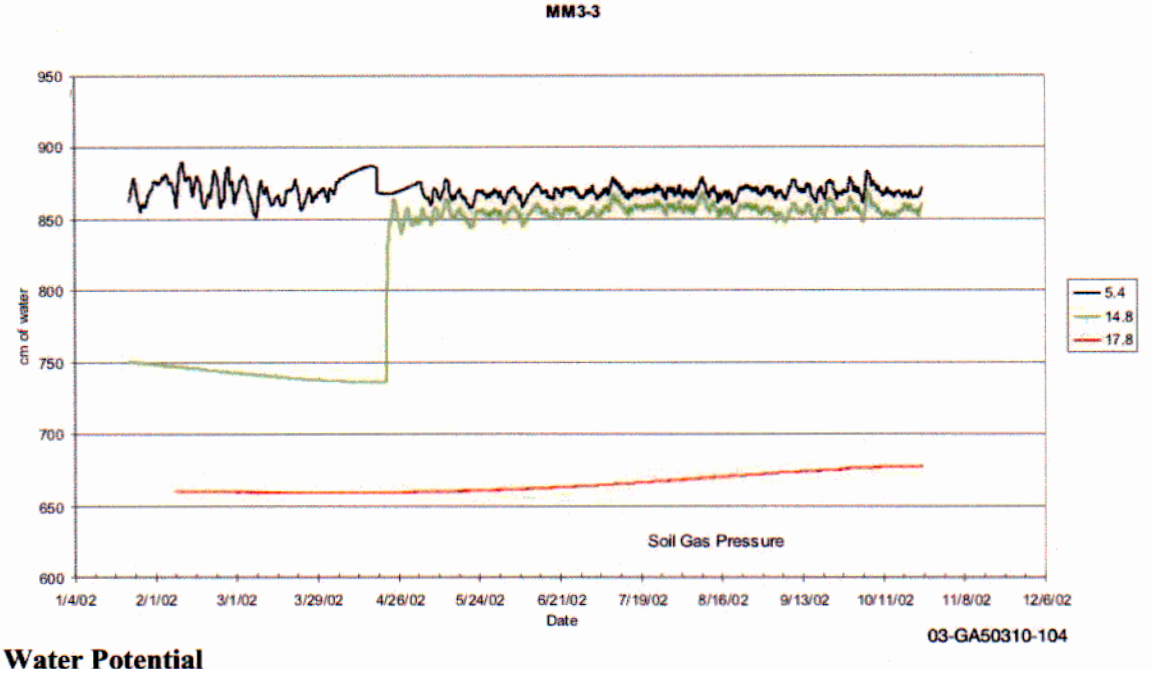
All three **need to be filled with water. The *9.2* may have reversed** wiring **(upper and lower)** and **should be checked.**

soil Gas Pressure

The *9.2* may have reversed wiring. The other sensors are tracking properly.



03-GA50310-103



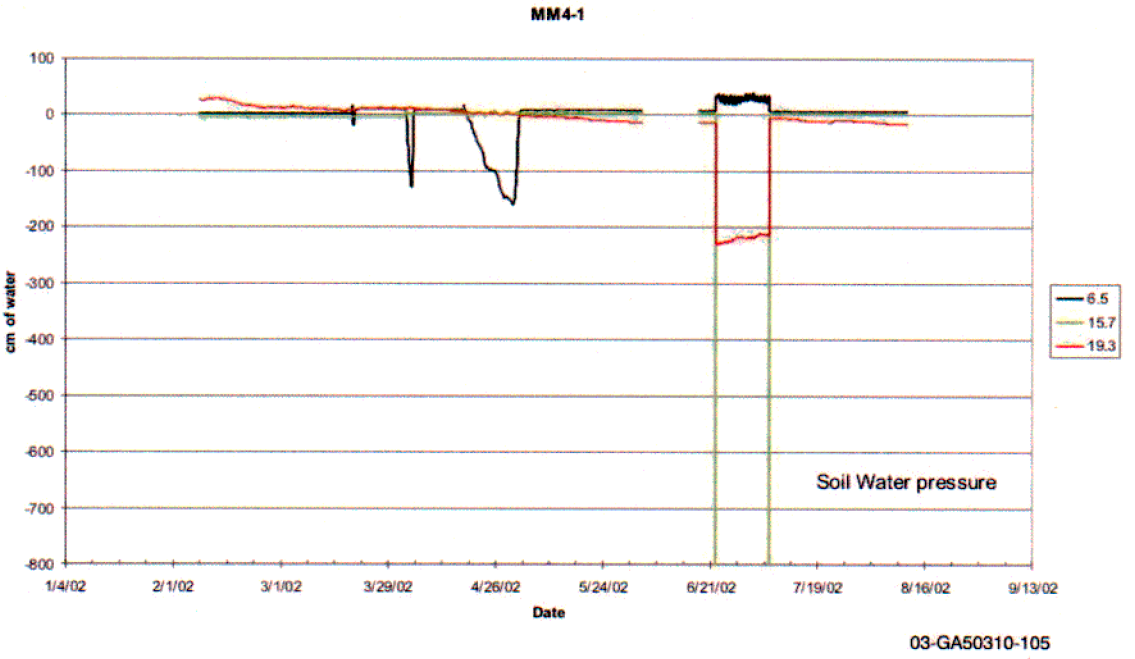
03-GA50310-104

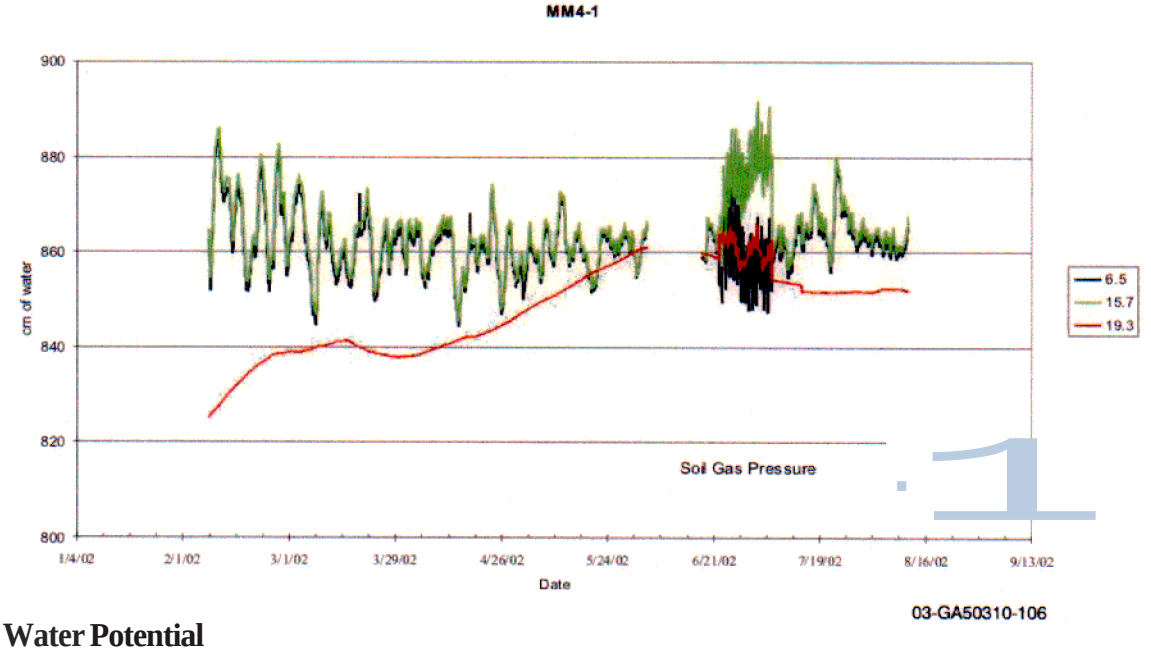
Soil Water Potential

The 14.8 and 17.8 may both have reversed wiring. All three need to be filled with water.

Soil Gas Pressure

The 14.8 and 17.8 may both have reversed wiring. The 5.4 is tracking BP.



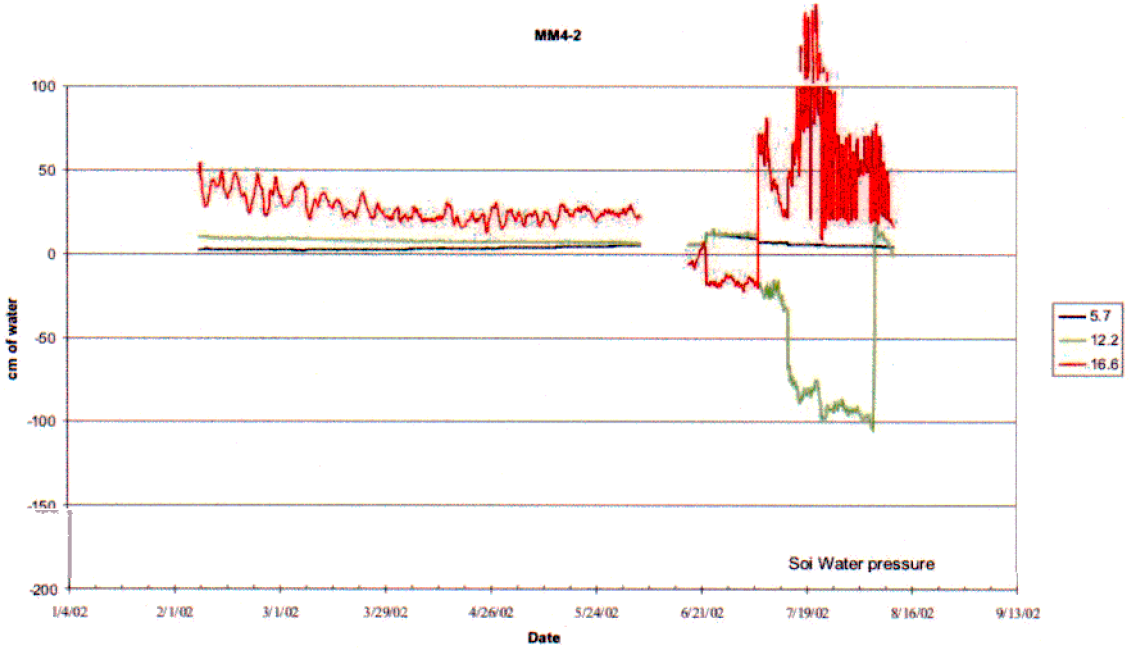


Soil Water Potential

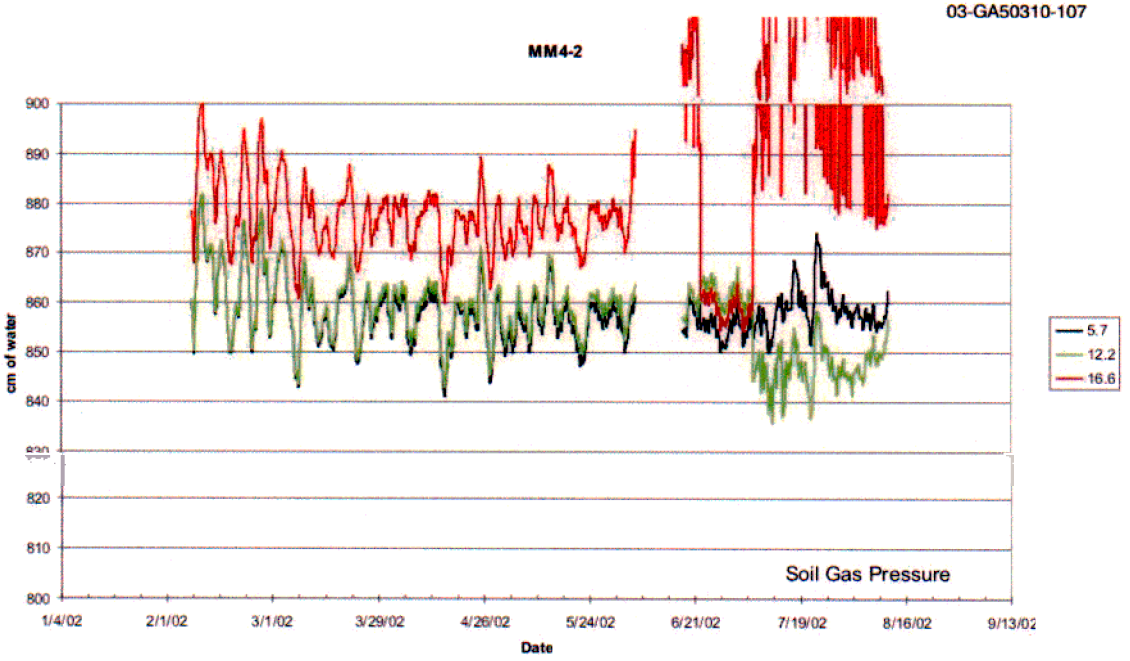
The 6.5 started to work in April but appears to have run out of water. The bottom chamber should be refilled, making sure that the SS is saturated. The 16.7 and 19.3 need to be checked and filled with water.

Soil Gas Pressure

The 6.5 and 15.7 appear to be working and gave similar data except from a time interval in early July when all the readings were slightly erratic. The 19.3 ft depth needs to be checked. It *appears* to be hydraulically disconnected with the soil *gas* pressure.



03-GA50310-107



03-GA50310-108

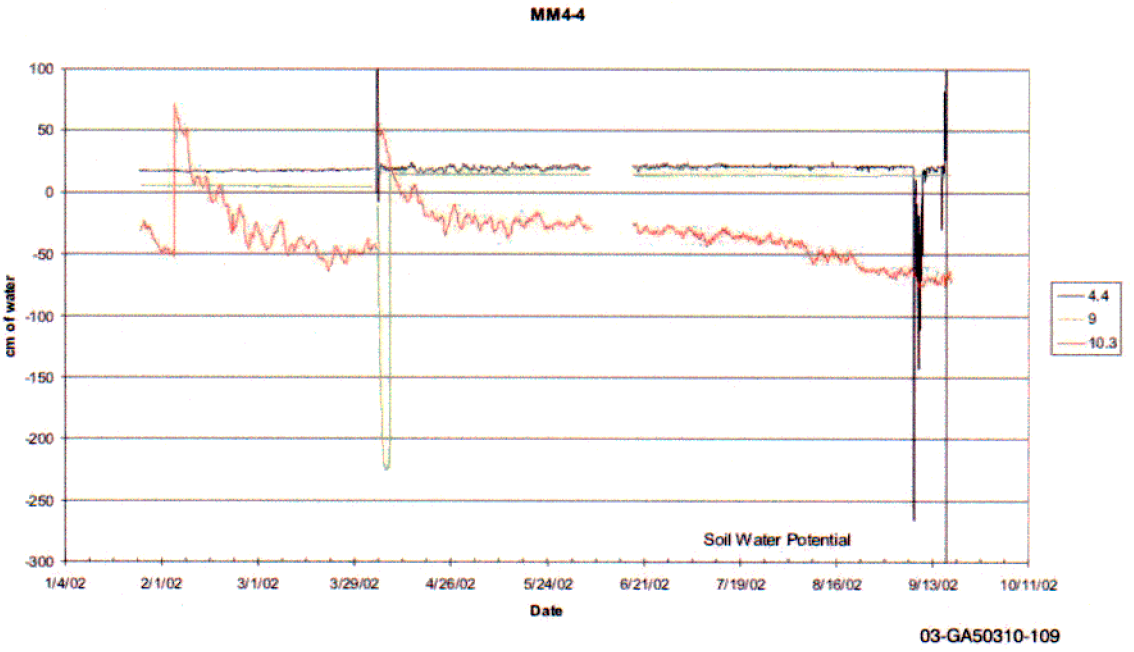
soil

Water Potential

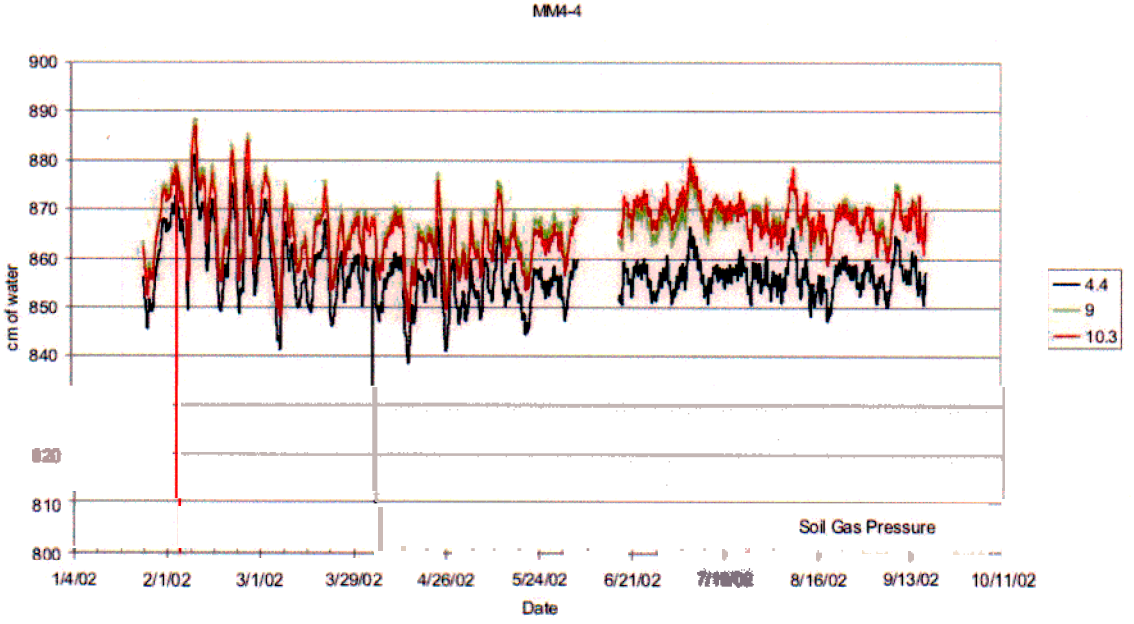
The 5.7 is tracking the barometer suggesting the SS is not wetted. The 12.2 appears to have been wetting in July but has run out of water. The 16.6 was tracking to May but appears to be erratic at this time. This suggests a wiring or electrical problem.

Soil Gas Pressure

The 5.7 and 12.2 were tracking until July when the 12.2 shifted and so needs to have the calibration checked. The 16.6 appears to be offset (to high pressure) and has been erratic (check wiring) since July, indicating potential wiring problems.



03-GA50310-109



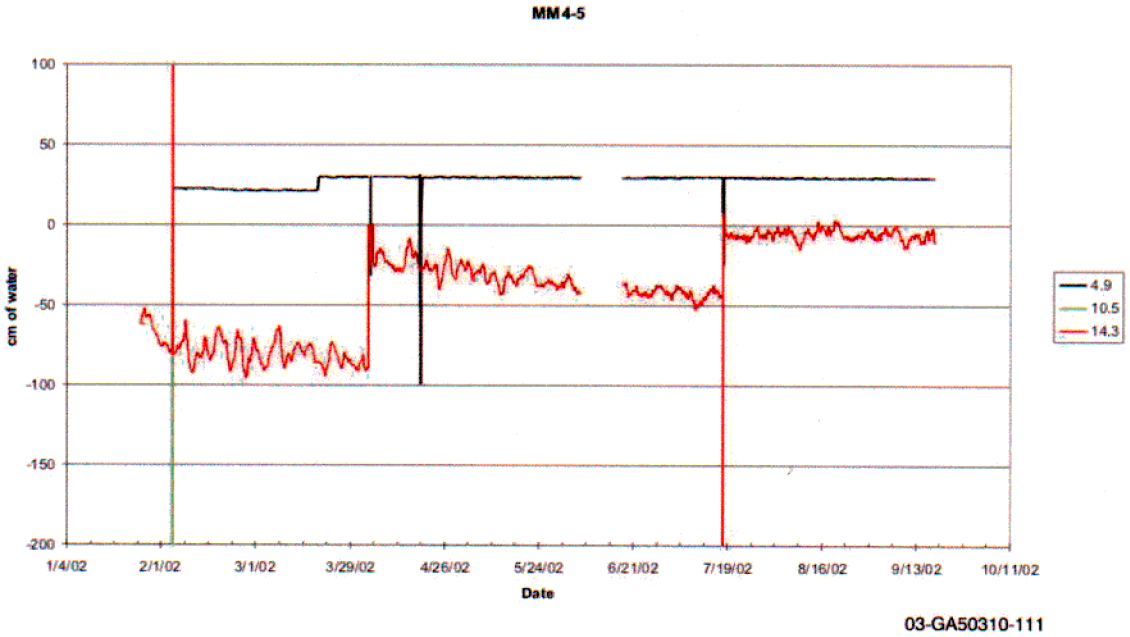
03-GA50310-110

Soil Water Potential

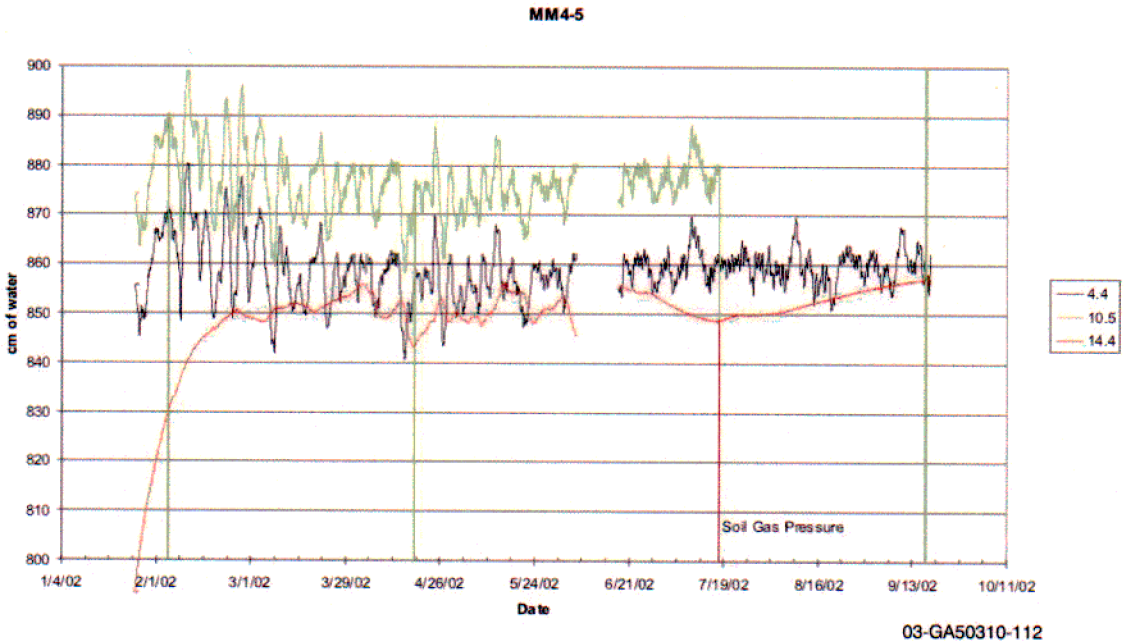
The 4.4 and 9 track the BP, so the SS is probably not wetted up. The 9 was operating in early April but now needs additional water added. The 10.3 appears to be operating correctly.

Soil Gas Pressure

All of the soil gas pressures track each other suggesting that the offset may just vary.



03-GA50310-111



03-GA50310-112

Soil Water Potential

The 4.9 is tracking the BP suggesting that it needs to be filled with water. The 10.5 transducer reads -69 cm suggesting a wiring problem or failure of the transducer (no output). *The* 14.3 appears *to* have been operating correctly; however, it needs to be filled with water. It may be near *or* at saturation.

Soil Gas Pressure

The 4.4 and 10.5 track, suggesting they are functional but offset by about 20 cm, indicating calibration check is in order. The 16.4 *appears* to be sealed from the soil *gas* or may indicate saturated conditions at this depth.

Appendix G

Tensiometer Probe Summary Status

Appendix G

Tensiometer Probe Summary Status

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G-1. BACKGROUND

Data from the direct push tensiometers were evaluated to determine the status of the water pressure transducer in the lower water chamber. This information will provide guidance on what needs to be performed on each of the instruments. These determinations were made based on the data from the johbe2 file and not the data collected on PC during field activities. Raw data and all plots are accessible at the shared file, jmh/shared/DP Tensiometer. Only the tensiometer is evaluated in this write up (not gas pressure, i.e., upper valve). For the color impaired, a letter is added as to the status with G for good, B for need to add water, Y for electronic or calibration problem, and R for no apparent response to *opening* the valve, so it needs to be actuated again.

G-2. LEGEND (FOR INSTRUMENT DEPTH)

	Color Identifier
Appears to be working—do not disturb	xxxxxxxG
Was working—started to work but needed to add water	xxxxxxxB
Valve opened—try to refill again	xxxxxx-DB
Transducer problem—electrical, calibration, or erratic	xxxxxxxY
No response to valve Opening (125 psi)	xxxxxxxR
Valve not checked at 125 psi—other problem	xxxxxxx

Notes: Instruments in the 743, DU, MM2, MM3, and MM4 sites were pressurized (potentially at higher pressures –125 psi) to open the valves the week of April 1–5. The 741, SVR, and MM1 were not pressurized at that time (several of these appear to be working).

Several sensors have gape in data that limit determination if the instrument responded to valve opening. Data will be used to the latest available data.

If the instrument does not show a cl[illegible] res[illegible] from activating the lower spool valve from data in the johbe2 file, it is noted as not responding.

Several instruments had multiple difficulties and were marked with two colors.

Several instruments in SVR have electrical problems and were marked as such.

Data are updated for wells on 4/26/2002: SVR-12, SVR 20, 741, DU-08, DU-10, DU-14, MM1, and MM3. Other tensiometers were not revaluated since the remaining instruments w e n not manipulated in the field.

First, refill those that were working but ran out of water.

Second, try to refill those that did not respond the first time and those where the valve opened but did not indicate filled with wate[illegible]

Table G-1. Probe completions in the depleted uranium focus area.

Cluster Name	Recommended Action	Tensiometer	
		Probe Name	Instrument Depth (ft)
DU-08	Wiring probably reversed lower and upper transducer, refill with water.	DU-08-T3	16.4B
	Add water, probably working, continue to let run, logger off from June onward-turn on logger (for all of DU-08).	DU-08-T2	10.2B
	Check calibration on transducer, was running refill.	DU-08-T1	5.3R
DU-10	Do nothing—just watch and check calibration—strange jump in data~8/01?	DU-10-T3	9.1G
	Was working but looks like valve opened and did not close? Activate valve to refill again.	DU-10-T2	DB
	Refill with water.	DU-10-T1	4.0R
DU-14	Valve responded first time, repeat only to fill tensiometer, check calibration, and refill with water, logger was off in august—data available?	DU-14-T3	DB
	XD is erratic. Check calibration and wiring. Might be working.	DU-14-T2	9.0Y, G
	Wiring appears to be switched—upper and lower transducers. Was operating and need to add water.	DU-14-T1	3.7B

Table *G-2.* Probe completions in the Pit 4 organic sludge focus area.

Cluster Name	Recommended Action	Tensiometer	
		Probe Name	Instrument Depth (ft)
743-03	Working—just watch.	743-03-T3	18.5G
	Was reading *850,* but reading shifted to 1,500—check wiring and calibration.	743-03-T2	11.2Y
	Was working—add water by activating lower spool valve to refill with water.	743-03-T1	5.3B
743-08	Check wiring reading—69.	743-08-T3	22.4Y
	Check calibration and wiring of transducer (reading 1,600 and increasing).	743-08-T2	13.0Y
	Shifted reading after filling, might be working, check calibration to verify proper operation, ran out of water, or wet up. Refill with water.	743-08-T1	5.6B
743-18	Check response by activating lower spool valve to fill tensiometer, check calibration.	743-18-T2	14.9R
	Might be working but need to check calibration on XD, wiring may be reversed—showing wetting, may be running out of water-refill?	743-18-T3	9.2Y
	Check response by activating lower spool valve to fill tensiometer—check calibration.	743-18-T1	5.5R

Table G-3. Probe completions in the Pit 10 americium and neptunium focus area.

Cluster Name	Recommended Action	Tensiometer	
		Probe Name	Instrument Depth (ft)
741-08	Wiring appears to be switched in lower and upper transducer and appears to be working—do not need to add water	741-08-T3	19.9Y
	Was working but need to refill with water	741-08-T2	10.6B
	No response when activated lower spool valve to fill tensiometer—try to fill with water again	741-08-T1	3.6R

Table G-4. Probe completions in the soil vault rows activated metal focus area.

Cluster Name	Recommended Action	Tensiometer	
		Probe Name	Instrument Depth (ft)
SVR-12-1	Wiring problem (-263).	SVR12-1-T3	10.8Y
	Wiring problem (-263).	SVR12-1-T2	8.4Y
	Check response by activating lower spool valve to fill tensiometers.	SVR 12-1-T1	DB, Y
SVR-20-1	Might have been working to –12 cm, add water, and check calibration.	SVR20-1-T3	16.4B
	Reversed wiring? (check) might be working if wiring reversed.	SVR20-1-T2	12.7Y,G
	Reading 875 (atmospheric), add water, check calibration, and if wiring reversed.	SVR20-1-T1	,Y J

Cluster Name	Recommended Action	Tensiometer	
		Probe Name	Instrument Depth (ft)
MM1-1	Working—just watch.	MM1-1-T3	17.7G
	Working—just watch.	MM1-1-T2	10.5G
	Erratic, check calibration and wiring connections, fill lower chamber.	MM1-1-T1	5.6Y
MM1-2	Erratic, check calibration and wiring connections, wiring might be reversed?	MM1-2-T3	14.0Y
	Working, do not disturb, Shift in data?	MM1-2-T2	9.3G
	Wiring corrected, check calibration, and refill with water, not reading.	MM1-2-T1	Y
MM1-3	Wiring is disconnected to water and gas pressure.	MM1-3-T3	11.7y
	Was working but shifted 80 cm upward—check calibration, refill with water.	MM1-3-T2	8.4G

Cluster Name	Recommended Action	Tensiometer	
		Probe Name	Instrument Depth (ft)
	Working—do not disturb.	MM1-3-T1	5.1B
MM2-1	Working—do not disturb.	MM2-1-T3	16.0G,Y
	Check for reversed wiring in upper and lower XDs—do not need to refill.	MM2-1-T2	11.9G,Y
	Refill with water—was working-refill.	MM2-1-T1	6.7R
MM2-2	Check response by activating lower spool valve to fill tensiometers.	MM2-2-T3	9.2R
	Check response by activating lower spool valve to fill tensiometers.	MM2-2-T2	8.6R
	Refill with water check for wiring reversal?	MM2-2-T1	4.9B
MM2-3	Wiring problem (-263).	MM2-3-T3	6.6Y
	Check calibration, positive reading of +9 cm.	MM2-3-T2	DB,Y
	Check calibration, add water again—did respond but gave positive readings.	MM2-3-T1	DB
MM3-1	Probably working—check calibration to confirm, shows wetting.	MM3-1-T3	9.7G
	Wiring problem (-263), sensor dead.	MM3-1-T2	7.1Y
	Check response by activating lower spool valve to fill tensiometer, reading positive about 20 cm.	MM3-1-T1	4.9R

Cluster Name	Recommended Action	Tensiometer	
		Probe Name	Instrument Depth (ft)
MM3-2	Might be working, add water?	MM3-2-T3	8.4B, Y
	Responded to valve opening but not reasonable reading, try valve again and refill with water.	MM3-2-T2	DB
	No response—try checking response by activating lower spool valve to fill tensiometer again.	MM3-2-T1	5.0R
MM3-3	Wiring problem (-263).	MM3-3-T3	17.0Y
	Calibration or wiring problem reading 1,200, did respond, and appears to produce data but calibration off.	MM3-3-T1	14.0Y,G
	Was working—need to refill with water again.	MM3-3-T2	4.6B
MM4-1	Wiring may be reversed, check response by activating lower spool valve to fill tensiometer, fill lower chamber might be working, or logger off ?	MM4-1-T3	18.5 YR
	Valve actuated, need to fill tensiometer, and reading near zero.	MM4-1-T2	14.9Y, B
	Was working—fill with water.	MM4-1-T1	5.7B
MM4-2	Check response by activating lower spool valve to fill tensiometer—	MM4-2-T3	15.8R

Cluster Name	Recommended Action	Tensiometer	
		Probe Name	Instrument Depth (ft)
	gas XD is erratic.		
	Check response by activating lower spool valve to fill tensiometer and Logger off?	MM4-2-T2	11.4R
	Check response by activating lower spool valve to fill tensiometers.	MM4-2-T1	4.9R
MM4-4	Probably working—do not disturb.	MM4-4-T3	9.5G
	Was working—fill with water.	MM4-4-T2	8.2B
	Was working—fill with water.	MM4-4-T1	3.6B
MM4-5	Was working until disturbed, refill with water, might be reading but reading shifted, and check calibration.	MM4-5-T3	13.5 B, Y
	'electrical problems reading -69.	MM4-5-T2	9.7Y
	Was starting to work activate valve, and add water.	MM4-5-T1	4.1B